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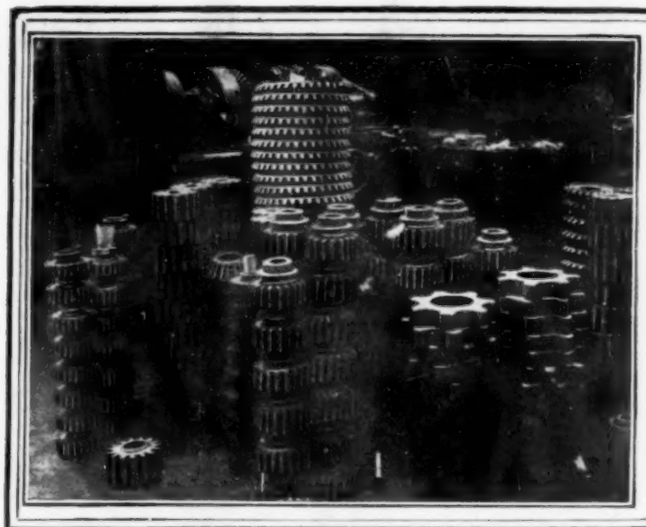


Grinding Operations on "Caterpillar" Tractor Parts

By FRANK A. STANLEY

The grinding operations conducted on the "Caterpillar" tractor include the finishing of a great variety of gears, bushings, shafts, piston pins, case covers, etc. Details are given of wheels, limits of accuracy, etc.

THE purpose of this article is to give in detail the data pertaining to the methods followed in the grinding department of the Holt Manufacturing Co.'s plant at Stockton, Calif. An earlier article was devoted to the manufacture of gears at this plant and the practice of the company in respect to grinding the bore of various kinds of gears.

Some of the illustrations in this treatise are included to show something of this grinding work. In this connection the headpiece should be of interest, as it represents a number of gears of various kinds and sizes ready for chucking and grinding. The greater part of this work is handled in Heald internal-grinding machines, and in Fig. 2 one of them is shown with a spur gear undergoing finishing in the bore. This gear has a bore 3.874 in. in diameter, is 2.5 in. long, and the allowance permitted in the grinding of the bore is only 0.001 in. from specified size and that must be on the plus side of the dimension.

FIGS. 2 AND 3. FINISHING THE BORE OF A GEAR IN THE INTERNAL-GRINDING MACHINE AND GRINDING TRUCK-WHEEL GUDGEONS

Like so many others finished by the same method this gear is of mild steel casehardened, and the wheel used on the internal-grinding-machine spindle is a Norton alundum, 46-K or 46-L. The wheel is 3 in. in diameter and is operated at a speed of about 5500 r.p.m. The amount of material left for grinding out with the wheel runs from about 0.015 to 0.030 inches.

The work is rotated at 120 turns per minute and the wheel is traversed through the work at a rate equivalent to about 24 in. per minute. The metal removed per pass of wheel runs say two or three thousandths, and the rate of production is eight gears per hour ground to micrometer measurements and held within the limit of 3.874 to 3.875 inches.

Another and larger gear has a bore of practically the same diameter as the one described, but as the width of the gear is only 2 in. better time of production is obtained, the number of gears of this size finished per hour being 10. The same grade of wheel is used as for this gear and the same rate of feed and speed of rotation employed as for the previous one. The greater output on the narrower gear is precisely in proportion to its length of cut as compared with the other gear width. In another gear of 3.748 in. bore by 4 in. wide the rate of grinding is five per hour or half that on the gear having a 2-in. face. A change-speed gear with a clutch is handled on the same type of grinding machine. This gear is of 1.939-in. bore, and is ground out with a $1\frac{3}{4}$-in. wheel rotating at somewhere near 5000 ft. peripheral speed per minute. The depth of the hole to be ground is nearly 4 in., but the diameter is only half that of the last example cited and the rate of grinding is eight per hour.

There are various sizes of bevel gears to be ground out in this manner. A typical example has a bore diameter of 2.187 in. and a depth of 3 in. The wheel speed and feed, allowance for grinding and limit of accuracy correspond to the data already given.

The large bevel gears shown stacked high in Fig. 1 are other interesting examples of internal grinding. They are 10.67 in. outside diameter and the bore is 4.175 in. in diameter by 2⅛ in. long. An allowance of 0.003 in. is permissible in sizing this bore and the work is turned out at the rate of five per hour.

The counter main sprocket is a heavy steel piece ground internally on an engine lathe with carriage fitted up with an internal grinding-machine spindle; a 36-K alundum wheel is used. The hole is 5.225 in. in diameter and the sprocket 2⅜ in. thick. Four of these sprockets are ground per hour, the amount of metal removed by the wheel ranging from 0.020 to 0.030 inches.

The gudgeon for "Caterpillar" tractor truck wheels is made of rolled stock casehardened and is a plain, straight piece of work nearly 2 in. in diameter by 16 3/16 in. long, turned to within about 0.020 in. of finished size. After casehardening it is taken to the grinding machine for sizing.

The piece is shown in Fig. 3 in the Norton No. 10 x 36-in. grinding machine with the operation just starting at the end. A 24-combination-L alundum wheel 20 in. in diameter by 5-in. face is used. The wheel spindle is driven at 1150 r.p.m. The work is rotated at 120 turns per minute corresponding to a surface speed of 60 feet.

These gudgeons are ground to the size required at the rate of 25 per hour, or in a little less than 2½ minutes each. A limit of 0.002 in. is permissible in the sizing of the gudgeon, which probably aids in keeping up the rate of production, although with the broad-faced wheel there is relatively little wear and the work can be held closely to size with a minimum of effort.

A piece handled in large numbers in the grinding machine is the piston pin, or wrist pin, made of seamless-steel tubing casehardened and ground to finished size. This tubular part is of fairly heavy section through the walls, having over ¼ in. of metal at each side. It is turned down to within 0.012 to 0.015 in. of finished diameter, and then put into the grinding machine for finishing.

Here again a 24-combination-L alundum wheel driven at 1350 r.p.m. is employed, the wheel diameter being 18 in. so that the surface speed is about 6250 ft. per minute. The work is rotated at 120 turns per minute or at a rate of about 60 ft. surface speed per minute.

The hollow piece is mounted on an arbor for grinding. It is held lightly, as only 0.0005 in. is allowed from standard size. The piece has to be sized to two different diameters as indicated. The larger, or main, size is secured by setting the stop to bring the wheel to position for sizing the body of the pin at one pass across the wheel surface. Then with stop thrown out the wheel is fed straight in to give the smaller diameter which is only 1¼ in. long, the wheel face in this case being 2½ in. wide. The pins are finished at the rate of 16 per hour, a lot of them being shown in the tote pan in front of the grinding machine in Fig. 4.

The reverse shaft is made from a drop-forging and finished by grinding to a limit of 0.001 in. for a length of about 20 in., the diameter being 2.437 in., on an alundum wheel, 24-combination-L 20 in. in diameter by 5 in. face. The wheel is driven at 1200 revolutions or 6000 ft. peripheral speed. The work is run at 100 r.p.m., equivalent to about 75 ft. surface speed. The metal to be removed ranges from 0.030 to 0.060 in., and so two operations are made for each shaft. The lot of shafts are run through the rough-grinding process, then the wheel reset and the entire lot passed through the machine again for a finishing cut. The same wheel is used for both rough and finish grinding. The first grinding operation removes the metal to 0.006 to 0.010 in. of size and the work is handled through this process at the rate of 18 per hour or say one in 3½ min. In the second, or finish, grinding operation 12 per hour are turned out, the time being increased to 5 min. each, owing to the necessity for holding the work to the limit specified.

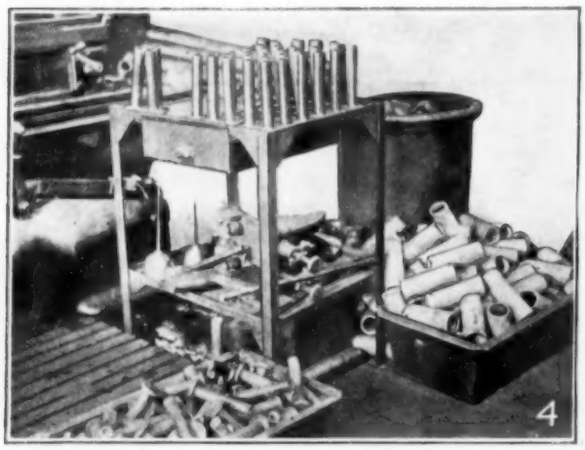


FIG. 4. PISTON PINS AND OTHER WORK NEAR GRINDING MACHINE

FIG. 5. INTERMEDIATE SHAFTS FINISHED IN THE GRINDING MACHINE

Intermediate Shafts

The shafts shown on the floor in Fig. 5 are part of a lot of such members made from nickel steel. They have a body diameter of 2¾ in. and a total length of 23¾ in. The ends are reduced somewhat for a distance of about 5 in. The piece is known as an intermediate shaft and has to be ground all over.

The work is handled in a Norton 14 x 50-in. plain grinding machine. The wheel used is an alundum 24-combination-L, 20 in. in diameter by 5 in. face. It is driven at 1050 revolutions, 5500 ft., per minute. The work is run at 100 revolutions, or 80 ft. surface speed. The depth of metal removed averages 0.030 in., and about 0.004 in. is taken off at each pass across the wheel. The rate of traverse of the work is about 72 in. per minute.

The time required for grinding the body and both ends complete is 15 minutes.

A gear and sleeve is ground on a Norton 10 x 36-in. machine, as shown in Fig. 6, with a 20 x 5-in.-face alundum wheel, 24-combination-L, run at the same speed as given for the shaft above, namely, 5500 ft. peripheral speed per minute. The work is driven at 85 r.p.m., or for the 3½-in. diameter approximately 80 ft. surface speed.

Here, as before, the allowance for reduction by grinding is from 0.020 to 0.030 in., and the time in grinding is about 10 min. each.

The work, having a $2\frac{5}{16}$-in. hole clear through the sleeve, is mounted on an arbor for placing between the grinding-machine centers. It is held to within 0.001 in. limit of accuracy.

Chilled-Iron Cams

The cams for these motors are made of chilled iron with special foundry appliances that will be described later. A cam detail is reproduced in Fig. 7, which shows all of the dimensions of importance and gives an idea of the form to be finished by grinding.

These cams are handled on a Landis machine with cam-grinding attachment, the wheel used being a crystolon 46-K running at 6000 ft. per minute. The work is driven at 50 r.p.m., or practically 35 ft. circumferential speed.

As the cams are cast in chills there is ordinarily little variation in the size of the work as it comes to the grinder. The amount generally left for removal by grinding from the casting is from 0.040 to 0.050 in. The limit to which the ground work is held is 0.003 inches.

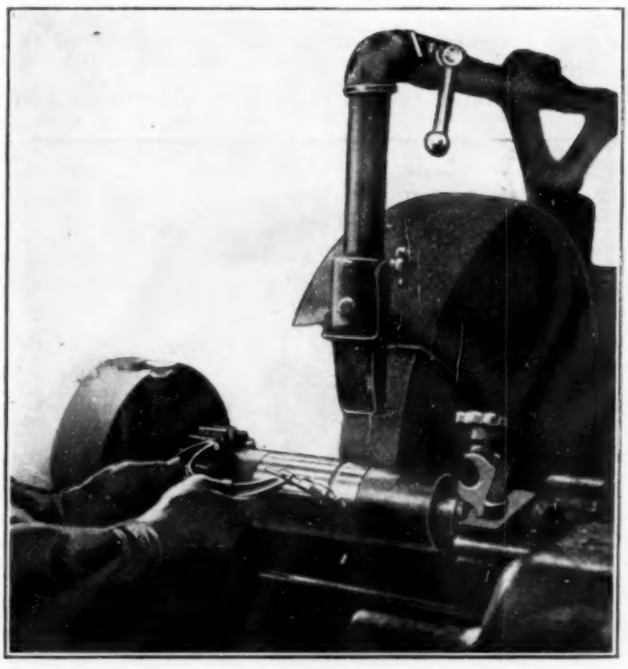


FIG. 6. GRINDING THE LONG SLEEVE GEAR

The wheel is applied by feeding in to the stop for depth and then feeding straight across the cam surface. The time required for grinding each cam is 3½ min. only.

Another job finished on the Landis grinding-machine is a casehardened mild-steel thrust-bearing washer 7½ in. in diameter by 0.325 in. thick, the limit of

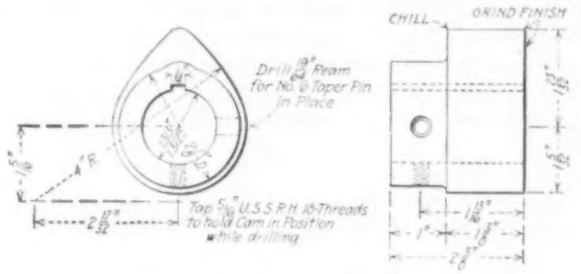

CHILL
GRIND FINISH
Drill 13/64" Ream for No. 6 Taper Pin in Place
Tap 5/16" U.S.S.P.H. 18 Threads to hold Cam in Position while drilling

FIG. 7. CHILLED IRON CAMS

accuracy in thickness called for by the blueprint giving 0.003 in. leeway or a maximum thickness of 0.328 inch.

The washer is ground on the faces only. It is held on a magnetic chuck and a 14-in. wheel with 1¼-in. face applied. The wheel is a 36-K alundum run at 6000 ft. per minute. The work is driven at 150 revolutions per minute.

The total amount of stock to be ground from the face is about $\frac{1}{32}$ in. The wheel removes 0.003 in. at each pass across the face and the job is completed at the rate of five washers an hour, or in 12 min. each.

A great many bushings of phosphor bronze, manganese bronze, etc., are finished in the grinding-machine department. A bushing for the small end of a connecting-rod is of manganese bronze. It is finished to 2.812 or 2.813 in., the limit being 0.001 in. It has a length of $3\frac{11}{16}$ in. and is placed for grinding in a Norton 6 x 32-in. plain grinding machine.

In turning these bushings $\frac{1}{32}$ in. of metal is left for removing with the wheel, and this is done very rapidly, the bushings coming from the grinding machine at the rate of 60 per hour, or 1 min. apiece.

A 36-K crystolon wheel is used, the wheel having a diameter of 14 in. and a thickness of 2 in. This wheel is operated at a surface speed of 5500 ft. per minute corresponding to a velocity of 1550 r.p.m. The work is rotated at 100 turns per minute or at a surface speed of 75 feet.

Another bushing 2.692 in. in diameter and 4 in. long, of phosphor bronze, is ground under practically the same conditions and at the same rate. It is a bushing for the truck wheels of the "Caterpillar" tractor, and here again only 0.001 in. limit is allowed in finishing the piece. Sixty-five are ground in an hour.

A longer bushing is also held to the limit of one thousandth of an inch. This piece of work has a length of $8\frac{13}{16}$ in. and a diameter of 3.432 in., so its total surface area figures out at almost exactly three times that of the connecting-rod bushing referred to above. The time required for grinding is in exact proportion, or 3 min. each.

It is ground with a 14 x 2-in. crystolon 46-K wheel operated at 1650 r.p.m., or at a surface speed of 6000 ft. The metal to be ground off averages from 0.015 to 0.035 in. and the wheel removes about 0.003 in. at each pass.

The small bushing 1.501 in. in diameter by 1.75 in. long is ground with a 46-L crystolon wheel of the same size as given above. It is run at about 5000 ft. per minute and removes from 0.015 to 0.025 in. of metal. The stop is set and the wheel position then remains unchanged except when dressed. One pass is made across with the work and the bush sized at the one cut. Although the piece is held to the limit of 0.001 in. the bushings are ground at the rate of 110 per hour.

The final operation to be taken up is the method of finishing cast-iron gear-case covers on the Pratt & Whitney vertical spindle surface grinding machine. A 24-H crystolon wheel is used here, which is run at 1150 r.p.m., and the wheel, having a diameter of 14 in., the peripheral velocity is about 4400 ft. per minute.

The castings have about $\frac{1}{16}$ in. to be removed in the grinding operation and are passed three or four times under the edge of the ring wheel in the machining process. The table is operated at the rate of six forward and backward movements per minute, so that only about a minute is consumed in the actual surface-grinding operation.

This department has many other details of interest, particularly in the grinding of crankshafts, cylinders and pistons. These operations will be described in other articles.

Grinding Round Work Without Centers

SPECIAL CORRESPONDENCE

In machine building today such accuracy is required in many small rollers, bushings, shafts and other parts that grinding is necessary, and if they could be produced without centers a considerable saving in time would result. This article describes a new grinding machine which handles these parts as fast as they can be fed to it without the necessity for centering them.

WITHIN the past few years a method has been developed for grinding the small cylindrical parts used in gas engines, roller bearings, etc., in the shape in which they are produced by automatic screw machines.

The machine for doing this work is built by the Detroit Tool Co., Detroit, Mich., and for some time was used almost exclusively in its own shop, where this class of work was handled as a jobbing proposition. The company having changed its policy the machines are now sold to manufacturers, making its capabilities of interest to managers and foremen in general.

From a casual inspection this grinding machine appears very similar to an ordinary tool-grinding machine, but there are certain features of the wheel itself and of the grinding guides which are unique. In the first place the wheel is dressed at an angle of from 3 to 6 deg. with its axis, causing it to assume the shape of the frustum of a cone. The part to be ground is held in a jig or guide block along which it slides until it comes into contact with the wheel. From this point forward the work is rotated by frictional contact with the wheel, but by virtue of the varying velocities of different parts of the wheel surface and the fact that the guide stands at a slight angle from a horizontal position the speed of rotation is much slower than would be derived from a direct nonslip contact. The angular position of the guide serves also to feed the work past the wheel much as the traverse movement of the regular form of grinding machine would do.

Should the wheel have been dressed parallel to its axis this angular position of the work would have the effect of making an apparent convex surface of the wheel, but as the latter is dressed by a diamond which slides in the same guide block (already adjusted to the angle) the wheel presents a parallel surface to the work, though it would show a pronounced concavity if tested with a straightedge in a line parallel to the wheel axis. An alteration of the guide block is made for rough grinding, in which the angle is slightly changed, with the result that a progressive cut is taken as the work moves across the face of the wheel, otherwise all of the cutting would occur at the first point of contact, which is not desirable. The guide, however, is set back to its original position for finish-grinding, since this last cut removes but a small amount of material. A general idea of the arrangement of the guide block and its relation to the wheel may be obtained from Fig. 1.

There is a difference in the type of guide used for rough and for finish-grinding, a section through the center of the first being shown in Fig. 2 and of the latter in Fig. 3. Considerable difference in the general arrangement will be noticed particularly in the position of the top guide strip.

The removal of the entire grinding allowance cannot

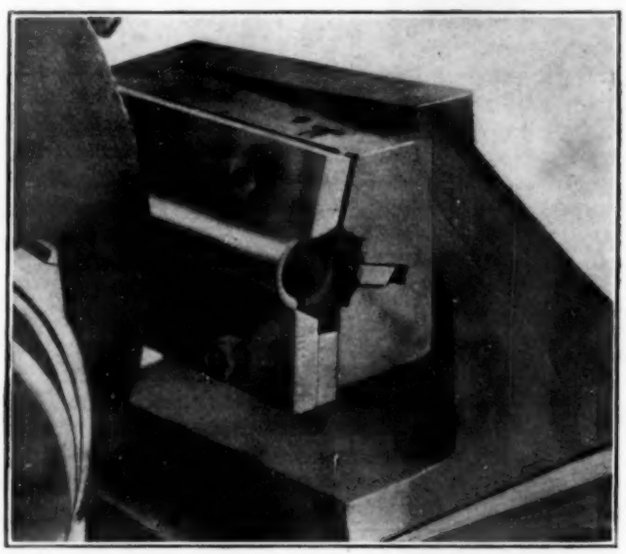


FIG. 1. ARRANGEMENT OF GRINDING WHEEL AND GUIDE

be effected in one passage of the work across the face of the wheel because of the tendency of the work to jam under the heavy pressure, resulting in stoppage of the rotative movement and the grinding of a flat spot the whole length of the work. Even though the work could be kept revolving the wheel would be rapidly worn away and it would be impracticable to maintain a definite size of work. If, for example, a roller was to be ground, on which there was a grinding allowance of 0.020 in., six cuts would be made, the first, second and third being roughing cuts, each removing 0.005 in.; the fourth a semifinishing cut taking off 0.003 in., and the fifth and sixth finishing cuts of 0.001 in. each. These last cuts are so light that the wheel wear between the first and last piece of a batch is imperceptible and all pieces are of practically the same diameter. The several cuts are in a way analogous to the grinding of a shaft in a standard grinding machine where the feed is advanced at each traverse of the table, the feed movements growing successively less each time the wheel

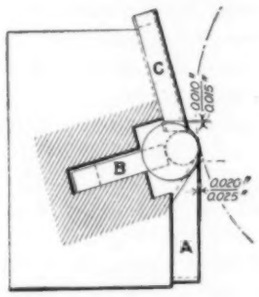


FIG. 2

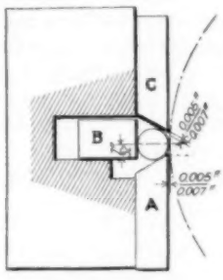


FIG. 3

FIGS. 2 AND 3. SECTION THROUGH CENTER OF GUIDES USED FOR GRINDING

Fig. 2—The guide for rough-grinding. Fig. 3—Guide for finish-grinding

makes a pass over the work until the final advances are very small in proportion as the finished diameter is approached.

In order to overcome any inclination of the work toward chattering, the center of the guide is located somewhat below the level of the wheel axis, so that the wheel pressure will have an added tendency to hold the work in contact with the hardened strips *A* and *B*.

One of the essential elements to good work with this machine is the care with which the three guides strips *A*, *B* and *C*, Figs. 2 and 3, are ground and adjusted. The strips *A* and *C* are not subjected to much wear, particularly strip *C*, because it is not in close contact with the work. The strip *B* receives the greatest amount of wear, which is principally due to the grit from the grinding wheel. The point of contact of the work with this strip is below the center line of the latter, as may be seen by reference to Fig. 3, and when the wear has become appreciable at this point the strip is turned over, presenting a fresh surface. Reversing the strip in the holder provides still two other surfaces; thus four wearing points are furnished for each regrinding of the strip.

Some varieties of the work done on this machine are illustrated in Fig. 4. It should be understood that the work is both rotated and fed forward solely by contact with the grinding wheel, and therefore when pieces like *A* and *B* are being put through, means must be provided for separating each piece from the one following to prevent interference. This can be done by flat washers, but in one case it was accomplished by large steel balls, which served the purpose admirably.

There are several ways of feeding the work into the fixture. Large and long pieces are fed individually by hand. Shorter pieces are sometimes fed through a V-shaped groove, while very short pieces, such as those shown at *C* and *D*, are fed through a tube or magazine. A number of these tubes may be provided, part of them being used for feeding the work in and the remainder used at the other end of the guide to receive the pieces as they come through.

Where the quantity of work warrants the employment of several of these machines they may be so arranged that successive cuts are taken by a series of machines, and in this case where the magazine feed is used the tubes are transferred from the receiving side of the first to the feeding side of the second machine, making it necessary to load the tubes but once for each complete cycle of operation.

The use of a grinding solution is very necessary in this process, the solution serving not only to hold down the temperature of the work but also to some extent to lubricate it as it revolves in the guide before the wheel. A compound of soda and oil, to which is added a certain

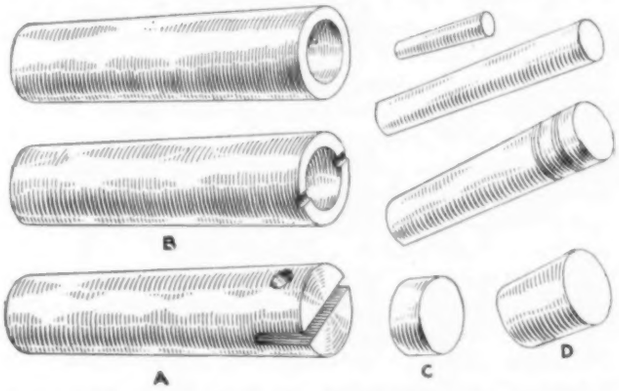


FIG. 4. SAMPLES OF WORK GROUND BY THIS PROCESS

amount of soap powder, is used, which acts as a lubricant and gives a free turning movement to the work in the guide. For heavier work more soap powder must be added to the solution in order to increase its lubricating properties and to make sure that the work does not stick.

A chart covering a number of years and showing the average rate of production has been prepared by the makers of this machine. While it is too involved to warrant reproduction in these columns it may be briefly stated that the output of these machines runs as high as 1600 pieces an hour in finishing rollers $\frac{9}{16}$ in. in diameter and $\frac{1}{4}$ in. in length.

The rough-grinding, as would naturally be expected, shows a lower production rate on all sizes than the finishing operation, but a peculiarity of the process is that the operation time is not relative to the diameter, the highest rate of production being on pieces of $\frac{1}{2}$ and $\frac{9}{16}$ in. in diameter, decreasing in varying proportion as the pieces are smaller or larger than this size. The proportion of production to length of pieces is fairly constant. The chart was compiled upon a basis of steel rollers free from burs and showing a hardness of 60 to 80 on the scleroscope.

Service for Women in the Gisholt Shops

By J. V. Hunter, Western Editor, American Machinist

Recently when the dearth of labor was felt many industrial organizations turned to recruiting among women to fill the vacancies in their shops. In this article the procedure followed by a large Middle Western machine-tool company in training their newly found help is described. Their experience has proved to them that it is easier to introduce women workers into machine shops than many shop managers have believed possible.

IN THEIR endeavor to create skilled labor out of unskilled labor many mistakes have been made by shop executives, the chief one probably being their failure to train the unskilled help first in the fundamentals of the work it is to perform, the assumption being that it knows them. When the Gisholt Machine Co., Madison, Wis., began to study the problems arising out of training women for war work in its shops, it had no mistaken suppositions of this kind, for the reason that it knew that women as a rule are not familiar with shop terms and practices. With this in view the short course of schooling given them has been so arranged that the knowledge obtained will give an advantage even over many men, and the simplicity of the method of training should be of interest to manufacturers who are considering the employment of this class of workers.

It is well known that the average foreman looks with disfavor upon innovations, particularly in the help furnished to him, and when such changes compel him to exert greater effort to properly train his help he feels still further imposed upon. It is therefore remarkable on asking numerous foremen of machine shops how they viewed the introduction of women among their help to hear them say that after a short trial they almost unanimously approved it—this at a time when they were occupied both with their regular duties and with seeing that the new workers were being carefully trained. One foreman, for instance, replied: "They are better than the men we are hiring nowadays," and another, "Good! They are doing fine." The first one had found out to his sorrow that the men it is now possible to hire for general shop work are floaters who never remain anywhere long enough to do anything well, and who cannot acquire any degree of mental application, while the women are eager and willing to learn, and when once taught correctly continue to work the way they were taught.

The Gisholt school for training women machine-shop workers, like the Gisholt Service School for men, is far different from the usual training school. Both are the creation of the same general executive board, and both hold to the opposite extremes of training. Those who read the series of articles in the *American Machinist* describing the Service School for Men will remember that it was designed as a course in intensive training to bring up to the highest standard mechanics who desire to specialize in a particular branch of machine-tool work. The school for women on the other hand at pres-

FIG. 1. PRACTICE WITH THE MICROMETER

FIG. 2. EXPLAINING THE DIVISIONS ON THE SCALE

ent is covering only the most elementary subjects. It is in fact a kindergarten for training women, who have only little information on such units as the inch, and so enables them to absorb the knowledge of the shop. It is succeeding so well in its aims that the management purposes to expand the school and give more detailed machine-shop training to the workers before sending them to the shops.

In some training schools that fit women for machine-shop work the women are taught to operate only one single-purpose machine (such as are found in time-fuse shops). Other schools are based on the vocational-training and the apprenticeship systems, and they contain machine tools such as are generally found in the shop. The length of the course in the former schools rarely exceeds 10 days, but in the vocational or apprenticeship schools a longer tuition is required.

Length of the Course

The course of training in the shops of the Gisholt Machine Co. lasts only three days, and the women then go into the shop to become producers. The school does not perform the functions that most of the others are designed to do; it makes no pretense of furnishing experienced mechanics. Its sole duty is to train in the fundamentals.

What are these fundamentals? They are: measuring accurately with scale, caliper and micrometer, and practice in the reading of elementary drawings and blueprints. In this way the sponsors of the school assume that the student will quicker assimilate the general methods of machine-tool work and that they will not be so crude when they go into the shops.

Do you, as a shopman, think that such schooling is nonsense? If so, step into your own machine shop and, outside of the toolmakers and higher grade machinists, determine for yourself how many can caliper a shaft to within a sixty-fourth of an inch. Then of those who have passed this test find out how many can use a micrometer caliper and read it correctly. The percentage will not be high.

One of the girls running a lathe was asked how she liked to work. "Fine," she replied, "and, do you know, I can use the 'mike' on my work and that man over there has been running a lathe all his life and cannot?"

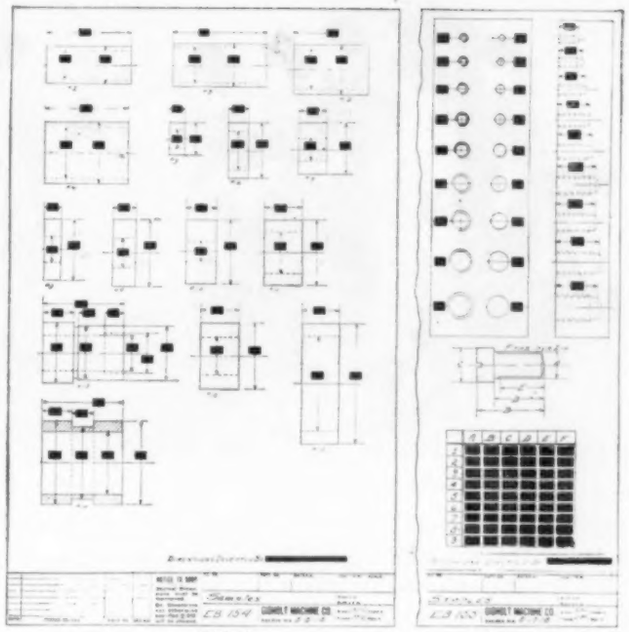


FIG. 6 FIG. 7

FIGS. 6 AND 7. CHARTS FOR RECORDING MEASUREMENTS AND VARIOUS DIMENSIONS

This is a fair illustration of the pride they feel in the work they are doing.

Wages in these shop are based on the premium system, with a guaranteed hour rate and a premium for increased production. After eight weeks or less the girls enter the premium-earning class and, at the same rates that the men receive, get premium checks for exceeding the basic rate of production. This shows what may be accomplished with women in the machine shop without extensive training, and if other managements could know the ease with which women are introduced in the shop they would follow this example. The idea that many managers have of elaborate training-school methods used by some firms has perhaps done much to cause them to hesitate, feeling that they had neither the space nor the time to devote to such experiments.

A view of one of the tables in the schoolroom is shown in Fig. 1. The equipment is simple—plain tables, chairs, an assortment of machinists' scales, inside and

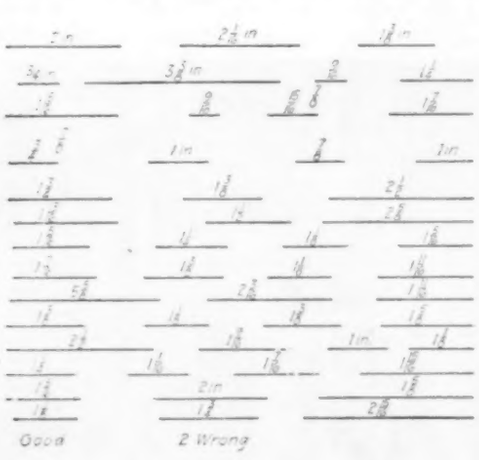


FIG. 3

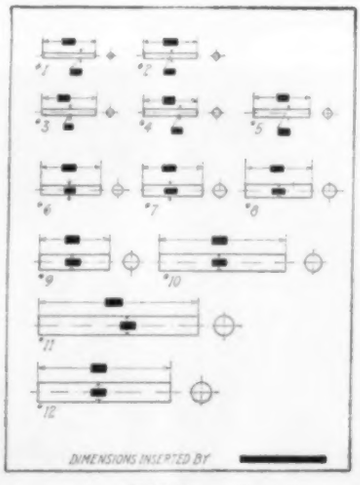


FIG. 4

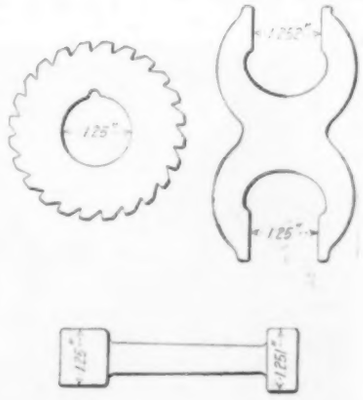


FIG. 5

FIGS. 3 TO 5. MEASURING, RECORDING AND SKETCHING

Fig. 3—Example of line measuring. Fig. 4—Chart for recording measurements. Fig. 5—Sample of work in sketching

FIG. 8. LECTURE ON READING SIMPLE DRAWINGS

FIG. 9. MAKING THE PIECES

outside calipers, micrometers and plug and limit gages. Two of the students from the earlier classes, having shown capabilities as instructors, are now in charge of the class room. The lessons of instruction follow:

Step 1.—Explanatory lecture on the scale.
Step 2.—Drawing lines and measuring same within limits of 1/16 inch.
Step 3.—Drawing lines and measuring same within limits of 1/32 inch.
Step 4.—Measuring cold-rolled stock for lengths and diameters, using both scale and calipers. Limits 1/64 inch.
Step 5.—Measuring sample pieces, getting length, bore and outside diameters in sixty-fourths, using scale, inside and outside calipers.
Step 6.—Lecture on micrometer; handling of same on work and reading the scale.
Step 7.—Practice in measuring cold-rolled stock, using scale and micrometer, and inserting dimension on blueprints provided.
Step 8.—Measuring sample of irregular-shaped pieces, using scale for length, calipers and micrometers for inside and outside diameters.
Step 9.—Sketching plug gage, milling cutter and snap gage; inserting dimensions in thousandths; use of thickness feelers.
Step 10.—Measuring standard threads; calipering drill sizes; gaging tapped holes and selecting machine screws to fit same; using depth gage; inserting dimensions as indicated on drawing.
Step 11.—Lecture and practice in reading drawings; display and lecture on machinists' hand tools, the uses of files, etc.

Few women know anything about fractions of the inch below quarters and many do not know even this. The instructor at the blackboard, Fig. 2, explains how the first chalked figure *A* represents one inch on the wooden scale which she holds in her hand, and that in this instance the inch is divided into halves. Further explanation regarding the charts *B*, *C*, etc., is given in respect to quarters, eighths, etc., and they are then practiced individually on fractions of an inch from the chart. The classes never exceed more than five girls.

Various stages of work at the tables in learning to use the machinists' measuring tools, interspersed with lectures, follow. Lesson 2, Fig. 3, is on ruling 50 lines on a piece of paper, and measuring their lengths; the work is checked by the instructor and the mistakes corrected by the student. This lesson is followed by exercises in the use of calipers and similiar devices for measuring the length, diameter, etc., of pieces of cold-rolled stock. These measurements are recorded by the student on a blueprint having blank spaces for the figures, Fig. 4, and which is a standard shop blueprint form. This practice, amplified by suitable explanations, affords the student knowledge of reading a blueprint.

A lecture on the use of and on reading the micrometer caliper is the sixth step, after which comes practice in using the micrometer, checking the measurements with a scale at the start, and transferring measurements made with the inside calipers to the micrometer for reading.

FIG. 10. GRINDING REAMER BLADES

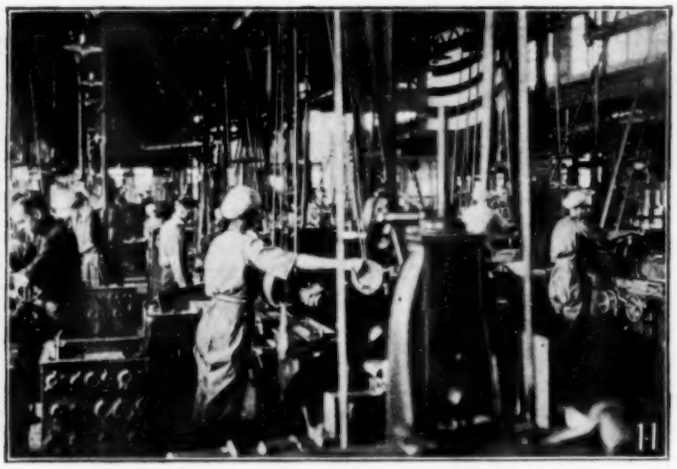
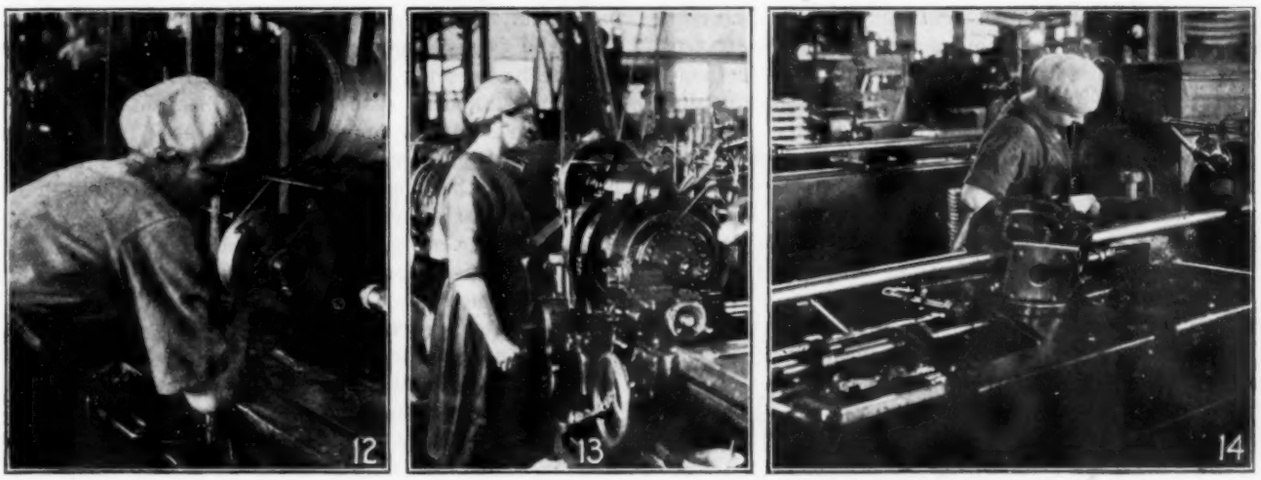


FIG. 11. TOOL-GRINDING DEPARTMENT



FIGS. 12. TO 14. WORK ON THE GRINDING MACHINE, LATHE AND TURRET LATHE

Sketching and dimensioning a few simple parts, as shown in Fig. 5, is given to gradually increase the student's knowledge of reading drawings. Another set of simple machine parts, Fig. 6, is provided for measuring more complex pieces, as well as practice in the use of thread gages and sorting machine screws to fit the different sizes and depths of holes; this is covered by the measurement chart shown in Fig. 7. Instruction in the use of the bevel protractor has lately been added to the course, and is intended for the use of those who will become shop inspectors. Between the lessons are lectures on reading standard shop drawings, Fig. 8, and it has been found advantageous to use samples of the parts that they represent together with the drawings so as to insure a clearer understanding.

Kinds of Shop Work Performed

Women were first used in the main shop office to replace the men who were called by the draft, after which it was but a short step to extend their services to the offices of the various foremen and inspectors throughout the shops as timekeeper and for crediting finished work for premium payments. Women had been employed in these positions for some time before the school was started for training the shop workers.

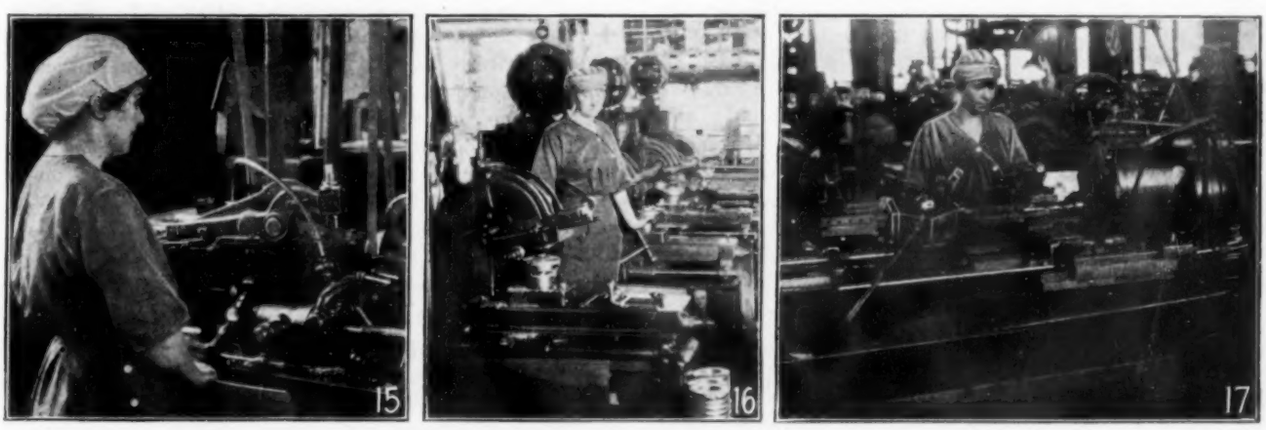
It has been more convenient to introduce women into the machine work of some of the shops than it has been into others; Fig. 9 illustrates a department having the largest percentage of women. They are employed on the simple engine-lathe and milling-machine operations.

One of the toolrooms employs a number of women on light grinding operations, much of the work being repetitive. The reamer blades being ground in the machine shown in Fig. 10 are an example of this kind. On this job two machines are working side by side, one grinding one face and the other finishing the parts.

A general view of the shop where many of these tool-grinding operations are done is shown in Fig. 11 and proves that the work that the women do is not confined to simple parts. Some of them are operating internal grinders. The one working on this type of machine, Fig. 12, is grinding a clutch part, each of which she must center in the chuck; in this case she is using a piece of chalk to mark the high side.

A machine for milling the rack on chuck jaws, Fig. 13, is also operated by a woman, who incidentally is earning about as good a premium as a man, althougn she has only been on this work a short time. The scrolls for these chucks are cut on a Gisholt turret lathe, which is also woman operated, Fig. 14. It is evident that while the women are not afraid of the cutting oil which is necessary for these machines, they keep themselves neater than a man would under similar circumstances, by providing themselves with an oil-proof apron which prevents the oil getting on their clothing.

A woman is cutting the teeth in the chuck bevel pinions, Fig. 15, and as these machines are semiautomatic she is able to take care of the whole battery. Others



FIGS. 15 TO 17. GEAR-CUTTING AND LATHE OPERATIONS

are likewise engaged in gear-cutting, Fig. 16, their work being supervised by a subforeman who checks it from time to time and when necessary makes adjustments and setups of the machines, the same as would be done were men of similar skill working on them.

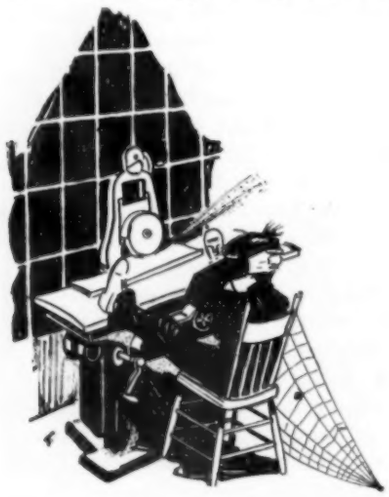
One would naturally expect to find in the Gisholt shops that women were being used on their own line of turret lathes; this is indeed a fact. Examples of these are shown in Fig. 17 and in the headpiece, the setup in each case involving the use of several kinds of tools. The woman working on the machine shown in the headpiece is handling a rather heavy piece and is using the micrometer in calipering it for width of flange, thus utilizing the knowledge which she gained in regard to the micrometer during her school period.

Hand Versus Power Feeds

BY HARRY SENIOR

On page 901, Vol. 49, Donald Baker takes toolmakers to task for not knowing the grains and grades of wheel to use on certain work, and further he says (in effect) that they would not use this knowledge to advantage if they possessed it, for they would set the wheel in too deep and turn on a fine feed, which would give them "plenty of time to sit back and rest."

It would seem to me that while they were "resting" there would be a fine opportunity for the foreman,



who of course knows all about these things, to instill into the minds of these poor, benighted fellows the information they lack to make them toolmakers.

The knowledge of grains and grades and their relations to various classes of work is especially easy to obtain. Several large manufacturers of grinding wheels and machinery maintain elaborate testing plants and laboratories and expend large sums of money to acquire information of this sort, and when it is obtained instead of bottling it up for their own delectation they spread it broadcast throughout the world in their catalogs, and not infrequently in the columns of the *American Machinist*.

Anybody who has the time and the price to attend a moving-picture show even for one evening, if he will send one-third of the price of admission (for postage) to any of these manufacturers, whose addresses he will find in the advertising columns of the aforementioned journal, and spend a little time studying the books and pamphlets he will receive in return, will not need to have the power feed taken off his grinding machine because he does not know how to use it.

I am inclined to suspect when I hear of shops that are obliged to adopt unusual or drastic methods to combat the ignorance of their men that the ignorance is not altogether confined to the fellows in apron or overalls. I certainly should not expect a wise foreman in charge of a gang of high-priced toolmakers to take away from them a most efficient mechanical means of expediting their work in order to make them do more.

If the measures adopted in the shop mentioned by Mr. Baker are correct, why not take the feeds off the lathe and other tools where they might be susceptible to misuse? Why not take off the lead screw? Some fool mechanic might gear up the lathe wrong and spoil his job. This reasoning is going to lead us right back to the "stone age," when the only tool known was a paving block with a handle on it, and even then some foreman might want to take the handle out so the workman could not rest his arm while pounding.

I have never had the opportunity to become closely acquainted with any of those toolmakers who do not know the rudiments of their business. To be sure I have seen many fellows who *said* they were toolmakers, especially during the last three or four years, but if I believed everything that anybody told me (particularly salesmen) I might be curator of the greatest museum of obsolete mechanical devices in the world—if the money held out.

I have had charge of the activities of men, even toolmakers, for some years, and I have learned to distrust the applicant for work whose former employer was a "d——d fool" or a "son-of-a-gun," for I am pretty certain that I am going to qualify for one or both of these classes myself if I hire him. On the other hand if I were looking for a foreman I should hesitate before employing one who had never had other than "ignorant," "careless" and "sloppy" workmen under his supervision, for fear that my fellows ("my" is an expression of comradeship, not ownership) who now constitute quite an intelligent and painstaking bunch would degenerate into ignorance, carelessness and sloppiness until they had reached the level of mediocrity that marked the upper range of the new foreman's mental vision. I have known many toolmakers who are ignorant of some of the things that make a man a toolmaker; indeed I have at times suspected that there were points that had escaped my own observation, but when I come across one who evinces a desire to add to his knowledge I try to teach him what I can and learn from him some of the things I have overlooked.

If the men in a shop are not up to the mark in efficiency or if that mark is set too low it is the duty of the foreman to take his feet off the desk, lay aside his cigar and teach them. In the case under discussion it was plainly the foreman's duty to instruct them in the proper use of grinding machines, not to partly disable the machines and leave the men to find out why. If the foreman was unable to do this he was not a foreman, no matter what they called him. I am a firm believer in the aphorism attributed either to Napoleon or somebody else—I don't remember which—"Incompetent armies are commanded by incompetent generals."

Efficiency in the Core Room

By J. B. CONWAY

It is the purpose of this article to set forth facts established by experiment and practice in the hope that the small foundry operator may benefit by them. Those who are having difficulties in the core department may find helpful ideas to assist them in solving their problems. The conclusions reached are the result of an investigation into conditions of efficiency and production in a Southern factory and the remedies applied.

CONDITIONS prevailing in a Southern factory, which included among its departments both iron and brass foundries, each having its own core room and other supplementary departments, compelled my being called to investigate them. About 250 men were employed in the plant, and the foundry and core departments required 25 workmen, including the foremen. On the whole the factory was new, modern and thoroughly equipped, but particular attention had been given the machine shop while the foundry had been somewhat neglected. This was discovered after a careful investigation and was the cause of the foundry not being able to properly produce the material necessary to supply the machine shop. Another serious drawback was labor trouble, which had been encountered some time previously when the management endeavored to put the department on piece work. This was later overcome as will be explained further along.

Conditions in the foundry were adjusted to enable it to secure greater production, but it was soon found that the core department was unable to supply a sufficient quantity of cores to maintain long runs without interruption. A survey disclosed a general lack of supervision.

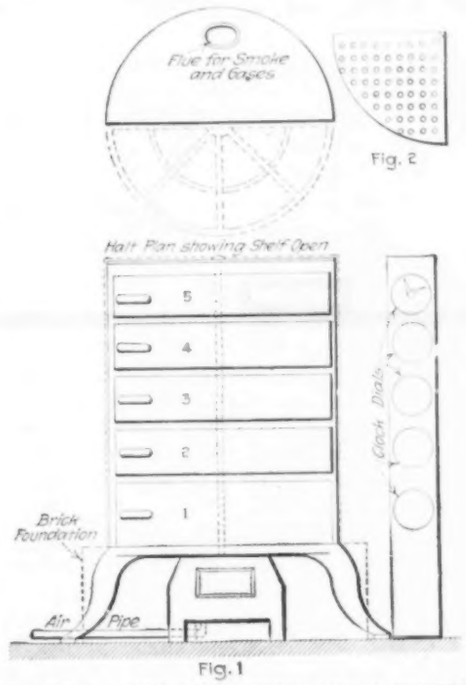
Divided Responsibility

The foundries were trying to operate under two foremen, one of whom was foreman of the iron foundry and pattern shop as well as part of the core room. There was no systematic method of making, baking, handling or storing cores; congestion was everywhere in evidence, and there were no adequate checking and recording facilities. There was also insufficient small equipment and oven capacity for baking the cores. The employees were careless and there was constant labor agitation by those affiliated with unions.

These evil effects were manifested in delays due to shortage of cores and bad work generally. There was antagonism between the workmen and foremen of the core room and foundry, and ill feeling on the part of the molders, who were often compelled to stand losses due to improperly made cores whereas the core makers received payment for everything marked up on their job tickets.

Although contrary to the usual procedure in such cases the first measure taken was to establish piece prices, and while this task was rendered more difficult by the fact that the deplorable conditions upon which the successful operation of the wage payment system depended were not given first attention, success finally rewarded our efforts. Much detail study was given to the various jobs, a half day sometimes being devoted to analyzing the several elements entering into the making of a core the actual making time of which was only ½ min. As the rate setting progressed a considerable saving was being effected, in some instances as much as 50 to 75 per cent. When the workmen had become accustomed to the new prices there was a tendency to rush the work unnecessarily, resulting in poorly made cores, but this trouble was eventually overcome.

It soon developed that one of the foremen was not in sympathy with the policies of the management and was distrustful of efficiency work in general. His antagonism was carried to such an extent that workmen reported that they had been instructed to hold back when time studies were being taken, and on entering the core room in the morning after the night crew had left I found conditions chaotic. Quite often the cores made the previous day, and which were sorely needed, were damaged until unfit for use. Curiously enough the foreman could never account for the damage nor did he make any endeavor to prevent its recurrence.



FIGS. 1 AND 2. THE CORE OVEN AND A SECTION OF DRIER PLATE

Prior to starting a night crew the cry went up for new core ovens, as it was contended that the ones in use were not large enough to meet the demand put upon them and that it would be necessary to work a night shift. There were three of these ovens of the type shown in Fig. 1, which is familiar to all foundry men. The management was reluctant to purchase new equipment at that time, and some of us were of the opinion that the trouble was due not so much to the lack of capacity as to the lack of something else.

Procuring a recording pyrometer it was determined to test whether the ovens were being fired properly and to ascertain the temperature at which the cores were baked. At this time the attendant whose duty it was to place the green cores in the ovens also attended to the firing when he thought it was required. As coke was used for fuel and a forced draft was necessary it frequently happened that the fire under one or more of the ovens died out, the rekindling of which was attended with loss of time and production.

The pyrometer terminal was located about 12 in. above the bottom shelf and the results of the first few days of the test are shown in the following table:

Date	Average Deg. F.	Tender
Feb. 14	406	Regular attendant
Feb. 15	405	Regular attendant
Feb. 16	495	Special attendant
Feb. 17	515	Special attendant
Feb. 19	565	Special attendant
Feb. 20	555	Special attendant
Feb. 21	535	Special attendant

The average daily temperature without a special tender for firing was 405.5 deg. for the first two days, and for the five succeeding days with a special tender the average was 537.7 deg. A noticeable fact was that the daily fuel consumption was less for the last five days than for the first two.

On the first day of the test a plate containing 147 cores of a certain type was placed on the lower shelf next the fire box, and one hour was required for drying them. On the third day the same number of the same type was placed on the second shelf, 14 in. from the direct heat of the fire, and they were dried in 55 min., although the lower shelf was loaded at the time. In the first case a temperature of 350 deg. was obtained, and in the second 525 deg. A gain of 8.33 per cent. in time was effected, which was later increased to 33.3 per cent.

On another job which required 4.72 min. for making the core 12 were baked in 35 min., proving that they could be baked faster than they could be made. This particular job was continually falling down because of the alleged insufficient number of drier plates. After this test there were no more delays on that account.

Rectangular drier plates were employed, and the maximum capacity of the shelves, on account of their semicircular shape, could not be realized. A casting of the shape indicated in Fig. 2 was made and used for certain types of cores, the character of which permitted them. These new-style plates were perforated to allow better ventilation and circulation of the hot air. Compared with the total available shelf area the old plates of the largest size gave only 553 sq.in. of baking area, whereas the new style provided 721 sq.in., or an increase of 30.4 per cent. in capacity.

On several parts an increase in production of from 10 to 110 per cent. was obtained. Another saving was effected by the less frequent trips to and from the oven. The results obtained thus far warranted delay in the purchase of new ovens. They also indicated that the limit had not yet been reached and that further investigation was needed.

The next measure was to conserve and utilize the heat that escaped from the fire box by radiation from the sides. A glance at Fig. 1 will disclose the possibilities. A brick foundation, outlined by the dotted lines in the figure, was built around the fire box and up to the oven, inclosing the box on three sides, the front being left open to permit firing. The outside of the ovens and the top were covered with metal lath and on this was placed a ½-in. coating of asbestos. By this improvement a temperature of 800 deg. was obtained and held with comparative ease, and 1000 deg. could have been reached had the fire box, which was of cast iron, been able to withstand the intense heat necessary. However, as 800 was sufficient for the purpose, it was not deemed advisable to go to further expense. The cost of the work on the ovens was approximately $30 an oven.

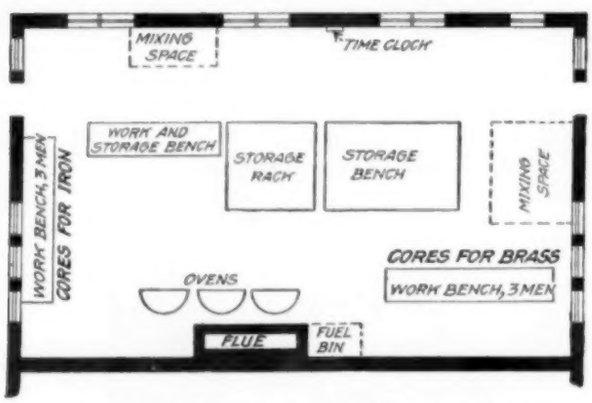


FIG. 3. FIRST LAYOUT OF CORE ROOM

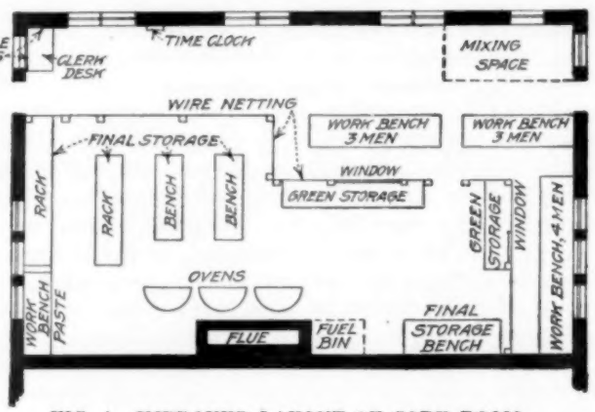


FIG. 4. IMPROVED LAYOUT OF CORE ROOM

Fuel Consumption Reduced

About 200 lb. of coke a day of 10 hours had been required per oven, which amount was now reduced by 50 per cent. At the same time the temperature was increased 35 to 40 per cent. and maintained between 500 and 650 deg. on the lower shelf during the entire day. The recording pyrometer faithfully registered every change in temperature and also acted in a measure as a check on the attention given by the tender.

In order to assist the oven tender a timing device was constructed and is shown at the right of the oven in Fig. 1. It consisted of sheet metal painted black, with white hands on the dials and white figures. The time indicated was that at which the cores were due to be dried sufficiently for use, and was obtained from tabulated records, an analysis of these records proving beyond question that the baking could be paid for on a premium or bonus basis. It was then being handled on a day-work basis.

At the time these investigations and observations were being conducted other conditions demanded attention. Mention has been made that there was lack of system. The reader's attention is invited to the layout of the department shown in Fig. 3. This was the general arrangement at the beginning, minus a miscellaneous collection of empty barrels and boxes, scrap

DAILY CORE REPORT

This report to be made daily and workmen paid from this record after approval of Foreman of Department.

Clock No.	Part No.	No. per Plate	No. of Plates	Pcs. Made	Pcs. Good?	Pay For	Cause of Defects: Handling	Broke in Oven	Too Green	Burned	Bad		Total Rej'd
217	1846	39	2	78	75	75					3		3
"	"	40	2	80	74	74					6		6
"	"	40	2	80	76	80		4					4
"	"	36	1	36	35	36	1						1
"	"	39	2	78	73	78				5			5
"	"	28	1	28	26	28			2				2
			10	380	359	371	1	4	2	5	9		21

Report must be finished as early as possible on morning following day on which cores were made and approved not later than 9:00 a.m.

DATE 2/20/17 Signed JOHN SMITH, *Foreman.*

FIG. 5. DAILY CORE REPORT

wires, cores, etc. Some of these articles were employed as benches for holding finished cores while the remainder rendered no service except to detract from the appearance of the department.

While the general arrangement does not warrant condemnation at first glance it should be remembered that there were two foremen and that there were times when serious differences of opinion arose. This together with the separation of the workmen produced a disagreeable spirit that created serious difficulties. Another objectionable feature was that no facilities were afforded for maintaining a check on either the daily output or cores in stock and any one had access to the finished product.

The arrangement shown in Fig. 4 was finally adopted and proved beneficial to both employees and management. A change of foremen placed the responsibility upon one man and tended to promote harmony among the men besides increasing the output at an appreciable reduction in cost. A partition of wire netting was built in the room and completely separated the core makers from the ovens and the finished product.

Upon completing a plate of cores the workman placed it on a shelf just inside the partition, from where it was taken by the tender and placed in the ovens. This arrangement produced a further increase in output, owing to the saving in time over the former practice of each man being his own "errand boy."

No correct record of the quantity of cores made, baked and stored was at hand, and it was apparent that little attention had been given the matter from the standpoint of economical production. Each workman was paid in accordance with the records on his job ticket, regardless of whether or not the cores were defective.

A form for a daily record of actual conditions was designed and is shown in Fig. 5. This report was in service only a few days when the management was able to ascertain where the trouble lay. For instance, it was found that a great number of cores were being broken at or in the oven, and investigation disclosed that the oven doors were out of alignment and would stick in opening and closing, resulting in the toppling over of the entire number of cores on a plate.

It may be wondered why it was necessary to introduce this form before discovering the defect in the ovens, so it may be said here that the trouble was known prior to this, but it required some concrete information to be presented to the "boss" before definite action could be taken.

Time Wasted on Defective Cores

Defective cores were baked, consuming time and space, and the core maker was paid for them. Cores had been removed before they were properly dried, with the result that they were so soft that they would not support their weight when placed in a mold. At other times they were left too long before being dried and were air hardened, a tough skin being formed which resulted in the center remaining soft after the core was dried. As the report was examined daily and any abnormal conditions investigated the situation soon began to clear up.

The workmen were paid for everything except cores having defects for which the maker was responsible. Cores were inspected before being placed in the oven and defective ones removed where possible, but with 20 to 140 on a plate it was not advisable to remove all that might be broken, as to do so would have meant spoiling perhaps many more. The oven tender was trained to inspect, and together with the foreman, covered the inspection nicely.

The clerk, who was added to take care of the clerical work of the foundries, also kept a record of the work of the core department. Before the clerk was installed the foremen were burdened with clerical work which they were not qualified to perform in connection with their other duties. More satisfactory results were noted as soon as the clerk took over this work; increased output from, and discipline in the departments were also achieved.

SCHEDULE BOARD

Part No.	Order No.	No Pcs.	Oper No.	Pcs. Reqd Daily	Oper. Waitg.	Oper. Workg.	Oper. Finished	DATE SCHEDULED AND STATUS OF JOB — START IN TIME: 1 2 3 4 5 6 NO. MADE NO. REJ'D BAL DUE	START IN TIME: 7 8 9 10 11 12 NO. MADE NO. REJ'D BAL DUE

FIG. 6. THE SCHEDULE BOARD

By this time sufficient progress had been made with the time studies and other development work to warrant a scheduling system based on facts, and a board, Fig. 6, large enough to embrace the records of both foundries and the core department, was made. This board was laid out on a sheet of celluloid 24 x 50 in. and about $\frac{1}{16}$ in. thick. The ruling was first made in pencil, then the lines scratched in with a scriber and

afterward gone over with ink to make a permanent record. Any lettering or figuring subject to change is put on in pencil.

The daily entries were made with pencil and erased at the end of each period, usually monthly, after they had been transferred to a permanent record sheet which was a duplicate of the board. By this means of recording the daily progress it was possible to check the cores made with the castings made and also to tell at a glance whether it would be necessary to make any alteration in the usual program in order to maintain the schedule.

Finally, to maintain future records that would be reliable, an instruction sheet to be used in conjunction with the piecework schedule sheet, which had been in operation throughout the factory, was designed. This sheet is self-explanatory and contains all the information necessary for a beginner to perform the operation of making a core, and also supplies the information necessary for planning the work. It is as follows:

Operation E1.—Bottom core for 1½-in. angle-valve body. Material—Sand and compound of the following proportions: One-half sharp sand, one-half molding sand (new) mixed and tempered with compound made of equal parts glutrin and water. Riddle mixture thoroughly until well tempered. Operation—Make one bottom core. Part 1440. Department 1300.

Description of suboperation. Set-Up—Procure necessary tools and supplies to perform work. (Note—Keep sand well tempered and do not work too dry nor too wet.) Set-Up Time—15 min. Tools Used—Core box 1440; sand; parting; vent wire; bench brush; mallet; strike off; adjustable clamp; supply 3- and 3½-in. wire; drier plate, 7 x 12 in.

Suboperation 1.—Brush box thoroughly and see that no sand or parting remains in grooves; use vent wire when necessary to clean grooves and corners; dust parting on both halves, place together; insert loose piece and clamp. Tools Used—Brush and parting. Time Allowed—30 seconds.

Suboperation 2.—Fill box with sand, using quick, firm stroke while filling; fill from both openings; have foreman inspect first few cores made to determine if sand is properly tempered and cores tamped properly before completed. Tool Used—Wood tamping stick ⅝ in. in diameter. Time Allowed—35 seconds.

Suboperation 3.—After box is filled place one 3½-in. wire in sand through top opening of box; fill box to level with sand and strike off flush; run vent wire through core within 1 in. from bottom; repeat this operation through side opening, using 3-in. wire. Tool Used—One strike-off stick. Time Allowed—35 seconds.

Suboperation 4.—Turn box over and rap lightly with mallet; release clamp and remove, placing clamp at right side for convenience; withdraw loose piece; draw both halves of box apart, taking care that box rests level on bench plate and that halves are pulled straight, otherwise core may break. Tool Used—One mallet. Time Allowed—25 seconds.

Suboperation 6.—Remove drier plate to oven when filled and bake cores until thoroughly dry; refer to time sheet and set time dial on oven to the time at which cores should be dried. Keep oven heat at not less than 500 deg. and not to exceed 650 deg. Remove when baked to cleaning bench to be cleaned and assembled with top core.

Time allowed for baking is as follows when temperature is maintained at 500 deg.: Shelf 1, 25 min.; shelf 2, 40 min.; shelf 3, 1 hour 7 min.; shelf 4, 2 hours; shelf 5, 3 hours 54 minutes.

Average time for baking one core, 3 hours 24 minutes.

Time allowed for making one core, 1 hour 25 minutes.

Total time, 4 hours 49 minutes.

Number required per hour, 48; per day, 480.

To summarize. The several forms and the schedule board made for better conditions in general, inasmuch as the records were so interdependent that it was necessary to maintain a high degree of efficiency in the various phases of manufacture and organization in order that each phase might function properly. If any one should be out of synchronism with the others it meant that all would be affected to the same extent. Under these circumstances deviations from normal conditions can be more readily noticed and measures taken to correct the trouble than if no such methods were available.

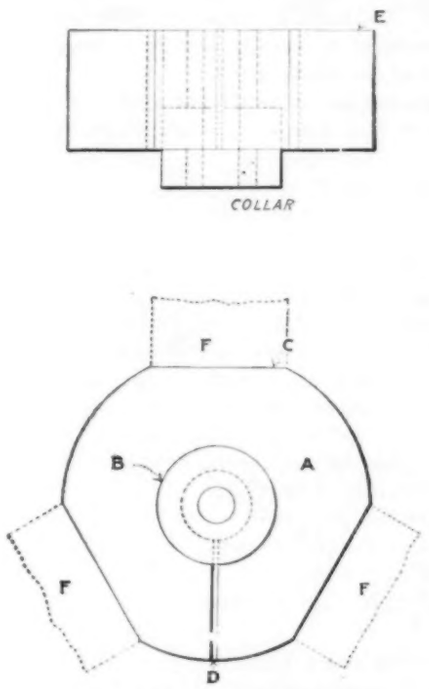
Further the cost department was enabled to obtain records for obtaining the cost of cores, and consequently the complete cost of castings, which had not been possible previously.

As the workmen became accustomed to piecework and the system, their general demeanor improved, their methods became more accurate and the work was accomplished with greater speed. The foremen evinced more interest in their work, for the reason that they had more time to give to it, and they also realized that for either department to fall down meant a loss in the one depending on them for stock. All concerned were soon interesting themselves in the development work and valuable suggestios came from some who had hitherto expressed contempt for any system whatever.

Chuck Grip for Collars, Etc.

By G. H. Roberts
Northampton, England

A simple little grip which will be found a handy addition to the vertical-boring and facing machine kit is here illustrated. It enables small articles such as collars, bolsters, etc., to be quickly and effectively set and held. It can also be applied to the lathe chuck. The grip consists of a short length of mild-steel bar *A*, of a diameter equal to that of the chuck register *E*, drilled and recessed as at *B* to give clearance to drill and provide accommodation for the work, the recess diameter being slightly greater than that of the job. Three flats *C* are then cut to form meeting faces for the dogs *F*, after which the grip is split by a saw cut *D* midway between two of the flats. The widths of a single saw blade will do.



CHUCK GRIP FOR COLLARS

In using the grip two of the dogs are screwed up to it and should be chalk-marked by the operator to indicate that they are thus permanently set for the work in hand, the remaining dog being solely utilized to hold or free the work.

To obtain an effective grip the dog opposite the slot must always be one of the first-named. Likewise a three-jawed chuck is more suitable than a four, but the grip can be applied as readily to the latter if the split is made between one of the flats and one of the dogs at right angles to this used for pressing up.

Steel-Mill Roll Shop on the Pacific Coast

By FRANK A. STANLEY

The roll-mill department of a large steel plant making mill rolls of cast iron, cast steel and chilled iron for rolling merchant bar in various sections is the topic of this article. In the description that follows data is given on the finishing of different kinds of rolls, the types of tools used and the speeds and feeds.

THE views presented in this article illustrate the equipment and methods of the roll shop at the steel plant of the Judson Manufacturing Co., Oakland, Calif. A general view in the roll shop is shown in Fig. 1, which gives a fair idea of some of the equipment for roll turning. The illustration also shows the overhead trolley and hoist system for handling rolls in and out of the lathes and for moving them from one department to another.

There are three kinds of rolls handled here, namely chilled iron, cast steel and adamite, the latter being most commonly used for making square and round merchant bar. The journals are turned before the roll is placed in the grooving lathe, where it runs on its own necks or journals while it is being turned to diameter and grooved to correspond to the other rolls in the set.

The rolls illustrated are nominally 10 in. in diameter. Actually they measure as follows: Bottom roll, 10⅛ in.; middle roll, 10¼ in.; top roll, 10⅜ in. As the rolls are geared together this difference in diameters gives the top roll a slightly faster surface speed than the middle roll; similarly the latter has a faster surface speed than the bottom roll. This is to produce a stretching effect upon the top of the bar being rolled so that it will tend to throw the bar down to the floor plate as it passes through the rolls and prevent it from curling upward with what would more than likely prove disastrous results.

This difference in roll diameters is a factor that the roll turner must bear in mind in finishing a new roll for an old set or in making a new set complete. Likewise in regrooving a roll or in making a new one he must also take into consideration the amount of wear on the others in the set, and all of his work must be done with a view to matching up his groove surfaces correctly, both as to section through the groove and as to diameters at all points. Otherwise results when the roll goes into the mill will be entirely unsatisfactory and the work will require doing over.

Fig. 2 illustrates typical forms of tools for use in the roll lathe. One square-nose tool is shown in operation on the roll, another is seen immediately in front of the tool clamp. Also a large half-round forming tool is shown in the same view, and in Fig. 3 a considerable number of tools of various shapes will be seen. These are all of course made to accurate templets.

The grooving tools are mostly about 1 in. thick, and in the majority of cases are made of Jessop's steel. As will be understood from Fig. 2 they are held down in place rigidly and they are supported by the lathe bed right up to the very point of cutting to obviate possibility of spring and chatter.

With finishing tools for half-round grooves the practice is usually to make them in the form of disks, which are ground accurately to the diameters required and at the same time relieved slightly on the face. The sharpening is a simple matter with these disk tools, as the face can be ground as required without affecting the diameter appreciably during the life of the tool.

Disk tools are generally secured by placing them on a holder where they are held by a bolt passing through a central hole in the tool.

Turning to the actual grooving of the roll, and assuming the work has reached a stage where the diameter is

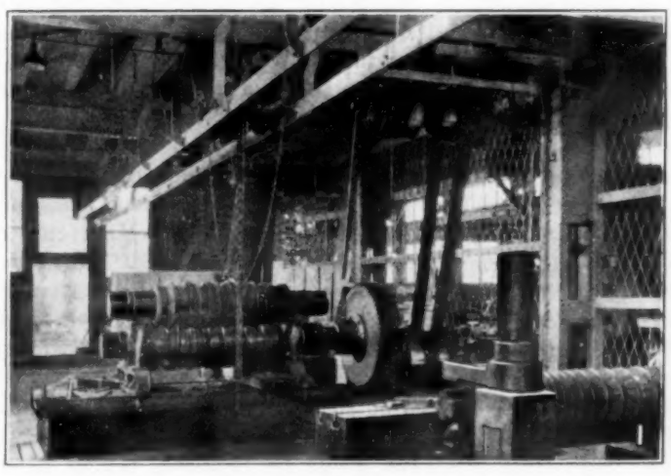


FIG. 1. A GENERAL VIEW OF THE ROLL SHOP

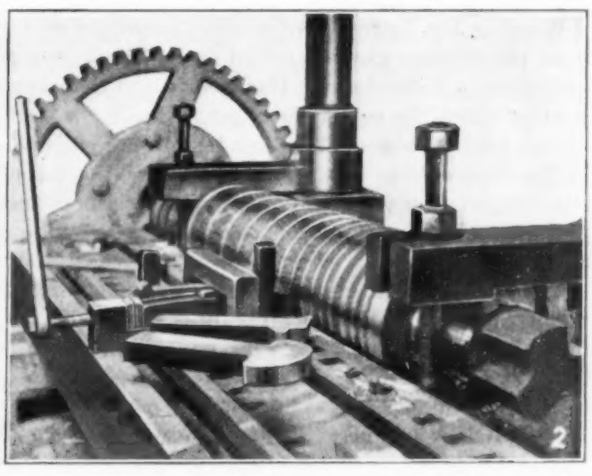


FIG. 2. ROLL IN THE LATHE AND THE TOOLS USED

correct and the grooves must be formed to match exactly with the corresponding grooves in the mating roll above it, let us refer to Fig. 4, which shows the roll to which the new one is to be made placed on the housings above the work in the lathe. The upper roll, being correct for spacing, form and depth of grooves, constitutes the master to which the other roll must be finished. It is therefore first set up on the top of the lathe housings and adjusted until it is perfectly parallel with the lower roll and it is clamped and wedged to prevent end movement as well as backward so that further gagings from its surfaces shall all be taken under uniform conditions.

Fig. 4 shows the manner in which the turner applies his calipers to determine if he has placed the grooves properly in the roll. At the same time he has to maintain constant check by calipering to see that he holds to the correct diameter for the bottoms of the roll grooves.

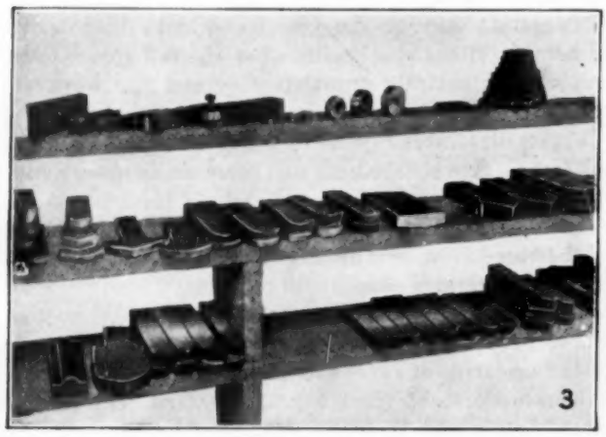


FIG. 3. VARIETY OF ROLL-TURNING TOOLS

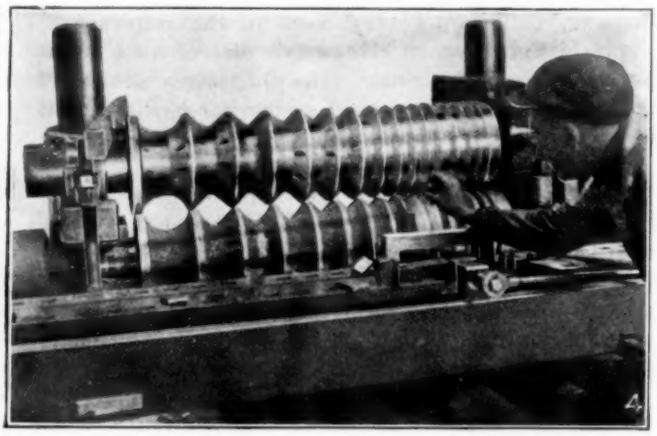


FIG. 4. CALIPERING THE GROOVES FOR ACCURACY

In the view just referred to he is checking the accuracy of the half-square groove in the lower roll by calipering diagonally across each way from the corresponding surface in the roll above.

It will be understood that in setting the upper roll the turner makes allowance for the width of gap, or space, between the rolls when in operation so that his measurements across the grooves in the pair of rolls are for the exact dimensions that will be maintained when the rolls are later placed in the mill for use.

Whether the grooves are square, round or of other form the calipers can be applied as indicated to assure the accuracy in the form of the grooves and their correct location along the roll surface, for as the form itself is always held at the same time to a templet which is placed in the groove from time to time the checking for position and relation to the grooves in the roll above means just the calipering from opposite directions obliquely, and any offset of the lower groove is revealed at once.

The foregoing operations are carried on satisfactorily only by the application of considerable judgment and experience. The average machinist has seen little of the special apparatus used in roll shops, and for a time at least he is inclined to have difficulty in understanding the necessities of the work, such as the requirements of very low turning speeds and consequent smoothness of cut, the accuracies as to diameters, forms, etc. It is a long job to complete a set of rolls and an expensive one at best, for a good many thousand dollars may be easily invested in a single set before it is finished, and if when the work is done there is unsatisfactory outcome through some fundamental error in the shop there is a still more expensive delay in getting a new set through for operation.

The slow rates of speed used in roll turning are well known to mechanics familiar with mill work, but a few words may be added here in reference to this phase of the undertaking. With the heaviest of roll lathes and the most desirable of conditions in respect to spindle drives, housing supports, proportions of roll necks and body lengths relative to diameter and so on it is conceivable that the average speeds in the roll shop might be increased somewhat; but there is apparently not the same opportunity to increase the speed to anything like the degree found possible with the general run of shop work, owing to the peculiar conditions of the job where the hardness of the material is a limiting factor beyond a certain speed. Besides the breadth the position of the cut—often a considerable distance from any point of support—bring about other limitations that necessitate holding the speed down to a low rate.

The rate of speed on cast-steel rolls will average about 9 ft. per minute during the forming of the broad grooves seen in the work. Hard cast-iron rolls are rotated at about 6 ft. per minute, while chilled rolls are run at 4 ft. per minute. With all of these rolls it is the practice to use first an old tool for scoring or getting down into the surface of the work.

In connection with chilled roll work it may be of interest to note the speed reduction between the driving belt and the roll as typical of this class of machine. The belt for example, traveling for a certain cut on a 16-in. pulley operates the driving shaft at 120 r.p.m., and through triple-gear reduction the spindle speed is cut down to $1\frac{1}{3}$ turns per minute, representing a speed reduction between the driving shaft on the machine and the roll itself of 80 to 1.

The rate of feed on such a roll will run say at 0.003 in. per turn, so that in cutting down about $\frac{1}{16}$ in. on a side some 20 turns would be required, taking about 15 to 20 min. for the depth specified.

Sales Engineering in the Export Field*

By S. T. HENRY
Vice President of the Allied Construction Machinery Corporation

This paper strongly advocates the use of trained engineers for salesmen in foreign markets. These men must not only be experts in the mechanical field but should also have a keen commercial sense in order to show prospective users how American machinery and methods can save them money.

LARGE and permanent export markets for standard American engineering machinery can be built up abroad by the introduction of American methods of using such machinery. Introducing American industrial methods abroad was a slow and tedious process until recently, though several large American manufacturers had conducted such work with success. They had sent into various countries sales engineers who were well grounded in the use of their machinery. While these engineers went as salesmen their work was to educate the engineers and the industrial men of other countries regarding American methods; they had to show these prospective customers why our way was the cheaper way; they had to prove that the use of our standard machines would produce results more quickly and economically than special machinery. These men worked under great handicaps, but they made good. They demonstrated that it was then highly practicable to sell standard American machinery instead of merely taking orders that were offered for special machines.

Change of Conditions

In the last two or three years conditions have changed completely. The world has learned more in that time about American engineering machinery and American engineering methods than could have been forced upon it in a generation of the most strenuous commercial efforts. Engineers from everywhere know the wonderful results our forces have achieved in building, equipping, and operating port works, railways, highways and machine shops in France. The world is now ready to adopt American industrial methods.

This change is demonstrated by the character of the inquiries being received by American manufacturers of engineering machinery who have made real effort to obtain export business. The bulk of engineers from overseas do not inquire now about the technical details of the machines only. They want to know how the machines are used, and whether the problems that they have to meet can be solved by American methods. The whole industrial world wants to be educated in our way of doing engineering work.

If the opportunity is handled right no limitations of trade possibilities need be considered. The thing to do is to put the work in the hands of men who are thoroughly schooled in American methods of using American machinery. These men must have commercial sense, and they must know how to deal with other business men. Above all they must have the "know how" of what they are trying to introduce. They must be able to sell ideas, not merely to take machinery orders.

A few examples may illustrate how such engineer salesmen work. Take the largest American manufacturer of mining machinery. This concern and its predecessors have consistently followed for a generation the policy of using engineer salesmen abroad. The company has branch offices or agencies in all countries of the world where mining and quarrying are done to any extent. In each of these branches or agencies is located one or more engineers who have had considerable experience in American methods of mining and quarrying.

What the Men are Selling

These men are actually selling drill holes in the rock and tons of ore in the car instead of rock drills and compressors. When a new proposition comes up they help to study the conditions to be met and advise what equipment will best suit them. In existing works they go right in and prove how American machinery and American methods will save money compared with what is being used. When up against cheap peon labor, in Mexico, for example, it is not easy to get a native mine owner to substitute an expensive mechanical plant for plentiful hand labor. He must be shown that the cost per ton of ore brought to the surface is less with such a plant.

Work of this kind is too "deep water" for a commercial salesman who can readily switch from shoes to millinery. It requires men who know from experience what the customer wants to know. Men of these qualifications become practically a part of their customers' organizations.

Here is another case. American sawmill machinery is used extensivcly in a Far Eastern country as a result of the work of a single American engineer salesman. This man knew thoroughly American methods of cutting timber, handling logs and running sawmills. When he went to this country a few years ago he was totally unfamiliar with its language. He went out and lived among the timber operators where he learned their language, their customs and their conditions. He did not meet the peculiar demands of the local lumbermen for machinery. Instead he showed them how American methods could cut more and better lumber for them at less cost. These American methods required standard American machinery.

Scarcely a logging or a sawmill job comes up in that country now without this man being consulted. His knowledge of the engineering side of the business, his keen commercial sense and his willingness to get right out on the firing line, far outweighed his previous lack of knowledge of the language and customs. No commercial salesman familiar with the language and

*Presented before the Technical Publicity Association, New York, Nov. 13, 1918.

the customs of the country, but lacking the engineering knowledge of the trade, could have hoped to make good at this work.

Numerous other examples of the success of American engineer salesmen abroad could be cited, but one more in an entirely different field should be sufficient. Hand labor is employed in excavating and loading into small cars quantities of a certain kind of commercial salt. The material lies almost at the surface in a stratum that is comparatively uniform in thickness and character over large areas of level ground. The industry is almost exclusively in the hands of English, German and native concerns. Their engineers were convinced that it was impracticable to use anything except hand labor in extracting the material from the ground and loading it into cars. At the same time climate and other conditions are such that it is very difficult to keep labor on the job.

Working under these great handicaps the industry became one of the principal lines of business of an important country. Each of the workings involves a large investment for an extensive refinery and for railways leading from the point of excavation to the refinery. The limitation on production is the amount of material that can be delivered to the plant. The cost of blasting and excavating the material also is a large part of the total cost of delivering the refined salt to the dock for shipment.

Result of One Visit

Based upon the opportunities thus presented an American concern sent an engineer salesman to study the situation, and as a result of the work he has done the indications are that the industry will be completely changed so far as field operations are concerned. The market thus presented for standard American equipment is a tremendous one.

Wherever you find an American sales engineer trained for work in foreign fields you will find him introducing American methods in the manner that these examples illustrate. At home you will find that the executives who have had experience with men of this caliber are convinced what overseas policy they must follow to get results. The ordinary commercial salesman will not do, but the engineer salesman of proper qualifications is almost assured of success in realizing on the opportunities presented in foreign markets to American engineering-machinery manufacturers.

Scarcity of the right kind of men is the one big problem in adopting a sales-engineering policy in export marketing. So many qualifications are desirable that an enumeration of them would appear to reduce the candidates to a very few. Just as in domestic work, however, it is rarely possible to find a man who matches up completely to the requirements of the job.

It is comparatively easy to find men who are thoroughly grounded in American methods of using any line of engineering machinery. When these men are sorted on the basis of ability to deal with business men the percentage of rejections is large. Those who do pass this test are nearly all eliminated when considered as to their commercial sense. This does not necessarily apply to their commercial experience, but rather to their ability to sense a commercial situation.

The few candidates left when these simple tests have been applied would nearly all be discarded because of their not knowing any foreign languages. It is frequently necessary therefore to overlook this essential qualification and send out a man who must learn the language after he has arrived, and any one who goes out thus handicapped is bound to have to work under great difficulties. The experience of numerous American engineering-machinery manufacturers has demonstrated, however, that such a handicap is far less serious than a lack of knowledge of American methods of using the machinery to be marketed.

Knowing the Buyer's Whims

This conclusion is heresy in the minds of most people experienced in regular commercial export trade, so it might be well to draw a line between marketing abroad commodities of ordinary commerce and selling engineering machinery. In the one case it is unquestionably necessary to adapt the commodity to the needs of the country. For example, it is impracticable to attempt to substitute an American hatchet for a Cuban machete. It is likewise necessary for a shoe salesman to know the whims of the average man and woman of the country in which he is trying to do business. But antiquated industrial and engineering methods are much the same the world over, and when any operation is large enough to justify the use of machinery instead of hand labor the work is nearly always in charge of men who can understand engineering arguments. These arguments are the same everywhere, but while it is a handicap not to be able to present them in the language of the men to whom an engineer salesman must talk, it is more so not to know what the arguments are.

The lack of business qualifications in most American engineers is a sad reflection on the work of our engineering schools. It is a fact that the courses in these schools tend to give young men a wrong view of the commercial side of engineering. Our technical societies also have overemphasized the ethical side to such an extent that an engineer who has anything to do with business loses more or less of his professional standing. This seems strange in the light of the fact that engineering is after all a matter of dollars and cents. This attitude of engineers toward business is probably a relic of the old days of pure-science education, but whatever the cause our engineering schools and societies will either have to get a new view of commercial affairs or fail to produce the engineer salesmen that American industry needs so greatly.

Suggestions to Technical Schools

Many suggestions have been made as to what courses our technical schools should give. One suggestion in regard to the foreign-language work required of engineer students may be stated. These courses could be given in a practical way. Young engineers should study a language as it is studied by men who must have it for commercial use abroad. Most important the student should be convinced of the value of the language to him. With some practical plan in place of the language study now given one of the chief handicaps to American engineer salesmen abroad would soon be eliminated.

Returning from these things as they might be to

things as tney are the average American manufacturer may want to know how he can use American engineer salesmen to sell his products abroad. This has been done in many ways, in each of which there have been some successes and some failures.

For the large manufacturer the problem is comparatively simple. He can afford to establish his own branch offices in the important centers of the world. He can also afford to supply his own trained men to coöperate with agencies in other centers of less importance. In the still more limited centers he can have his trained engineers on call to help local connections, scattered over a cosiderable area, to develop leads for business.

The manufacturer having a more limited output has three principal opportunities open to him under present conditions. He can turn his export sales over to one or more general export commission houses with branch offices in the countries in which he desires to operate; he can join with a group of noncompeting manufacturers in similar lines coöperating together to reach the foreign markets in which these manufacturers are interested, and he can bring together a group of his competitors under the Webb-Pomerene Bill to form an organization that will go after export business for all of them. The best plan can be determined only after careful study of what he wants to accomplish, the markets to be reached and his own limitations.

Methods of Some American Concerns

Some general export commission merchants have been quite successful in introducing and marketing American engineering machinery abroad. These concerns are of sufficient size to justify them in maintaining engineering-sales departments. These departments, to all intents and purposes, are separate machinery houses which utilize the experience and the facilities of the organizations of which they are a part.

Unfortunately the number of general export commission houses so organized is very limited. General export concerns that attempt to market engineering machinery as they do ordinary commodities make some sales, but in the nature of things they cannot build business.

Coöperative export engineering-sales organizations developed by a group of noncompeting manufacturers in allied lines is a comparatively new idea. Properly conceived, organized and financed, they apparently offer the average engineering machinery manufacturer one of his best opportunities to reach the available export market.

Such an organization insures each manufacturer of the benefit of thinking of all of the manufacturers in the group. This collective thinking eliminates many of the difficulties individual manufacturers encounter and permits the group to maintain properly trained engineer salesmen on salary in practically all of the centers of the world where there is an opportunity for the use of the particular general line of machinery involved. This means that each member of the group has good representation in many places where that member could not afford to have a salesman call even occasionally. Other advantages of the plan can be appreciated only by actual experience in its working.

Just how combinations of competitors under the Webb-Pomerene Bill will work in the engineering-machinery field remains to be seen. Thus far no such combination has been undertaken. In certain lines of commodities and of standard products there are undoubtedly advantages to be gained through operation under this bill. The difficulties apparently are such, however, that no group of competing manufacturers of engineering machinery has seen its way clear to attempt to get together in a combined effort to market its products outside of the United States.

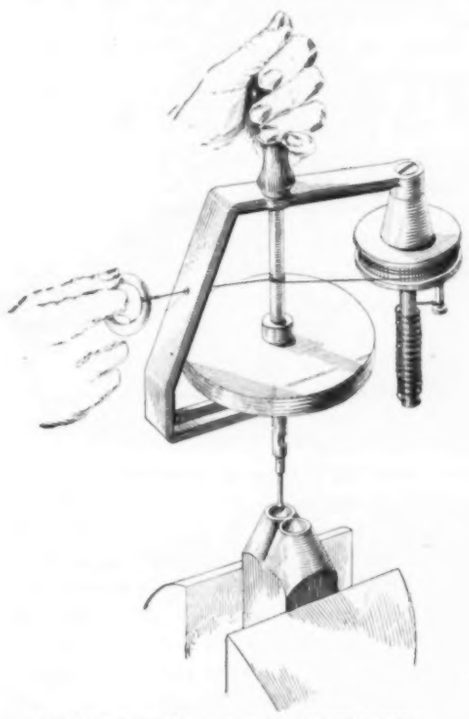
Whatever plan is adopted by the American engineering-machinery manufacturer in his export sales work he can build a large and permanent market only by introducing American methods of using his machinery. Such introduction can be made properly only by experienced American engineer salesmen.

A "One-Way" Bow Drill

By J. A. Lucas

In a small shop, a part of the product of which is steel letters and figures, the bow drill was frequently used for routing out portions of the work, such as the centers in the figure 8 shown in the cut.

The bow drill as ordinarily made runs backward half the time, and consequently is most unsuitable as a means for driving a cutter which has sharp and properly relieved teeth. The implement shown in the cut was made to overcome this difficulty and make possible the use of efficient cutters on the work in hand.



MODIFICATION OF THE BOW DRILL

The drawing needs no explanation as regards construction. When the cord is pulled the resistance of the rewinding spring causes the cord to wrap tightly around the spindle and revolve it. When the cord is released, there being no resistance to its return to the winding drum, it slips loosely around the spindle and the latter continues to revolve in its original direction by virtue of the momentum of the comparatively heavy wheel.

Making Shell Buckles and Brooches

By ROBERT MAWSON

In this article is shown the making of buckles and brooches from shells and ivory. The work is performed as far as possible on machines, though some of the operations from necessity are done by hand.

BY THE introduction of simple machines for making ivory or shell buckles and brooches it is possible to compete with the foreign-made articles which are largely made by hand.

Pearl buckles are made in great numbers by the Japanese. For these the workers are paid about 15c. a day for men and 10c. for women. The Providence Pearl Co., Providence, R. I., manufactures products which compete directly with these hand-made goods, and though the difference in wages here and in Japan is somewhat of an item, the increased production and superior finish of the domestic article give an advantage to the American-made goods.

In Fig. 1 are shown some of the types of buckles made. Those on each end are made with a cross-bar which is used to attach the buckle in position. The other three are made with a pin and designed as a fastening device for a belt. The various stages through which the shell passes when being made into a buckle are shown in Fig. 2. The shells employed for the work are imported from Australia. One of these as received at the factory is shown at *A*. The shell is first marked off into rectangular spaces to suit the outside contour of the buckle to be made and then cut up with a circular saw. One of these cut blanks is shown at *B*. The outer contour is then shaped by grinding on a wheel fitted with an exhaust system for removing the dust. The inside contour is then obtained by a similar method using a thin grinding wheel to suit the desired opening.

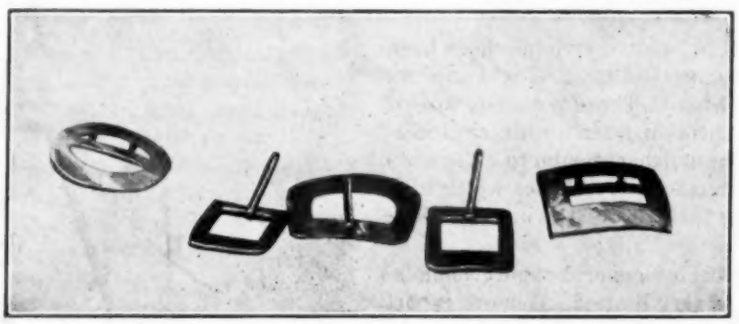


FIG. 1. A FEW SAMPLES OF BUCKLES

One of the blanks partly machined on the inside with the outside edge finished is shown at *C*. After the inside has been ground to the correct shape the buckle is polished on a buffing wheel. The buckles are next washed in muriatic acid to remove the dirt and also add luster to their appearance, afterward being washed in cold water. The final operation is drying by being placed in sawdust inside a rotating circular tank.

The average production from a shell is six buckles, which will convey an idea of the waste stock in the industry. This waste, however, is sold for fertilizing and other purposes so that it is not a total loss.

One of the grinding machines set up for cutting the inside contour of the buckle is shown in Fig. 3. The blank is held against the rotating wheel by hand and the inside contour produced. A number of the finish-ground buckles may be seen on the table and also in the box at the rear of the grinding machine.

A variety of shell ornaments used for brooches is also made at this factory. In Fig. 4 are shown the stages followed when making these ornaments. One of the shells used for the blanks is shown at *A*. This is cut into blanks in a manner similar to that followed when making buckles. One of the cut blanks is shown at *B*. The outer contour as shown at *C* is next obtained by grinding on a formed wheel. The design on the face of the ornament is obtained by cutting on small circular saws of the correct thickness, the workman holding the part in his hand.

This work depends largely on the skill of the man, who becomes so adept at it that the finished parts are practically the same as the original design of the sample.

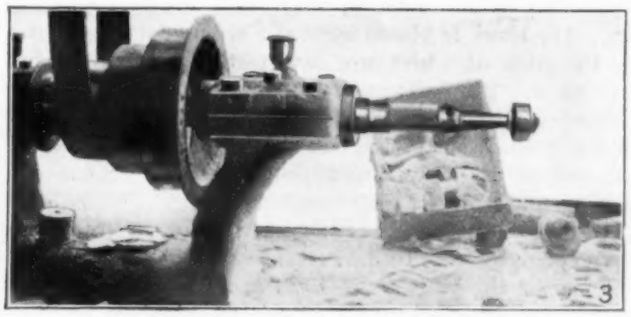
The ornaments are then washed and dried as previously noted. At *D*, *E*, and *F* are illustrated three of the finished designs of ornaments, the first two being leaves and the latter a bird. The method in which the contour is obtained by grinding is shown in Fig. 5. When grinding the first side the blank is placed in a fixture with a straight end and pushed against the revolving wheel by the operator. The grinding wheel is formed, as mentioned, to suit the shape to be produced. When grinding the second side, or the end, the blank is placed in the fixture as shown, which is made with an outline to fit into the contour that has been obtained by the first grinding. Stops are used for the fixture slide so that all the blanks are ground with equal contours and of equal size as regards width.

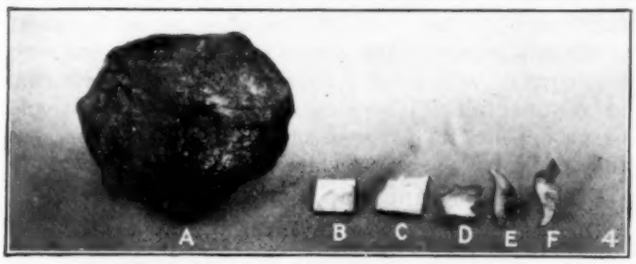
In Fig. 6 is shown one of the saws used to produce the design on the face of the ornaments or for cutting up shells. It runs at about 2000 r.p.m.

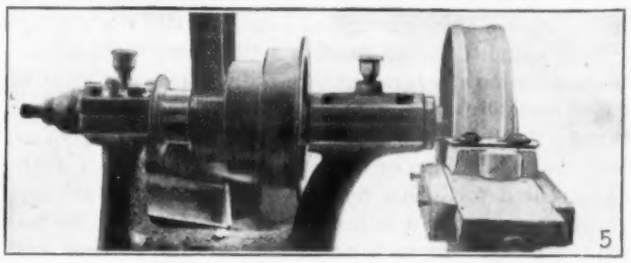
Some of the form wheels and templets used for producing ornaments are shown in Fig 7.

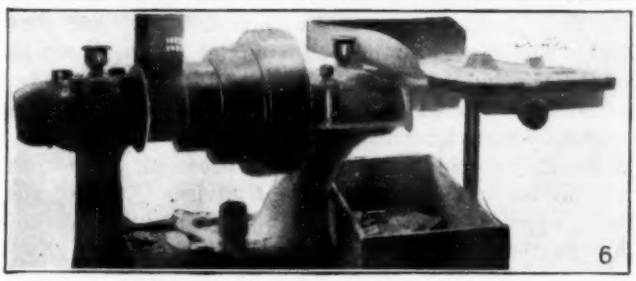
Another line of work being done in this plant is making French-ivory brooches. The steps in the making of one pattern are illustrated in Fig. 8. Blanks like *A* are received at the factory. They are then cut as shown at *B;* then the recess is made as shown at *C* and the outside form made as illustrated by the part *D*. This completes the work as done at this factory, the parts being then shipped to another concern where they are finished to the shape shown at *E*.

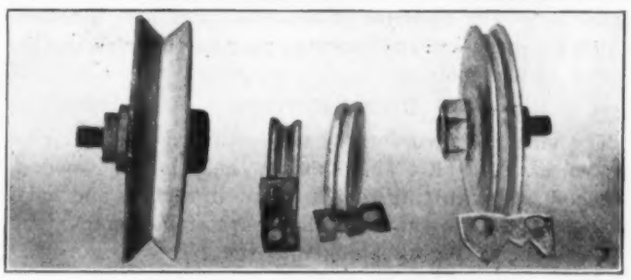
The machine used for cutting out the blanks is the specially built lathe shown in Fig. 9, which operates at about 2000 r.p.m. A trepanning type of milling cutter

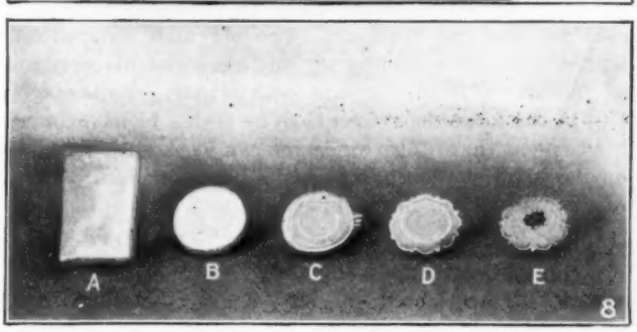


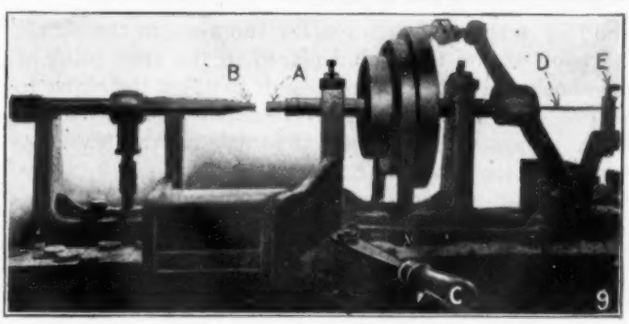


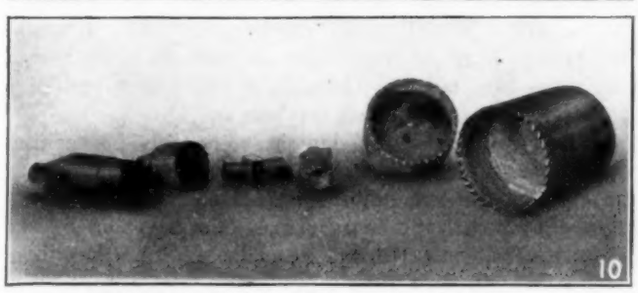


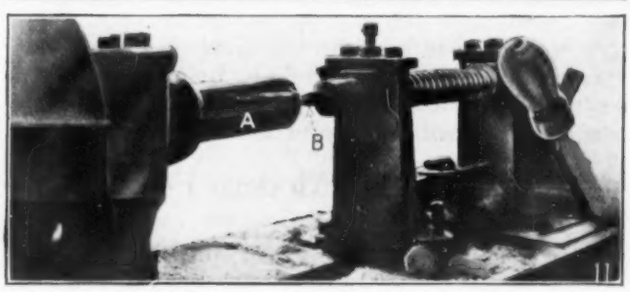


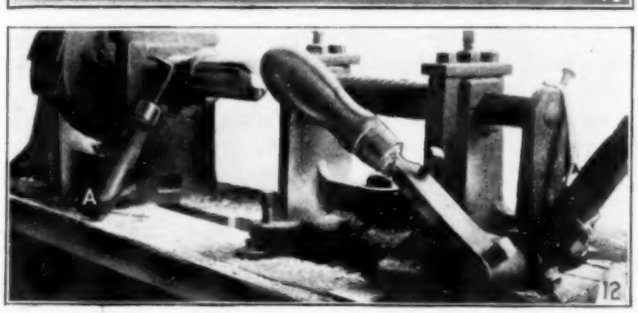


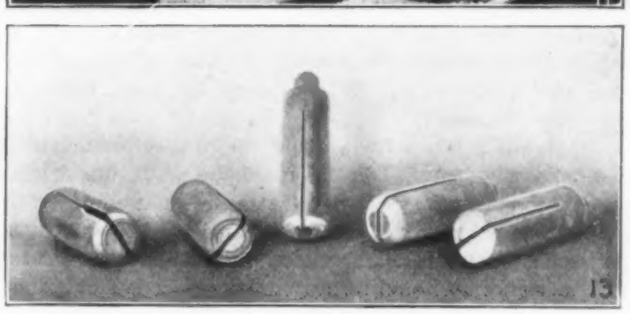












FIGS. 2 TO 13 VARIOUS PARTS AND TOOLS

A is used, in the center of which is a sliding push-out pin. The blank is placed against a circular holder at *B*, on the edge of which are saw teeth which assist in holding it. The cutter is fed in by pulling on lever *C*. After the cutter has passed through the ivory the round disk is pushed out of the cutter by means of the push-out rod *D* which passes through the center of the spindle and cutter. This rod can be set to any desired position by means of the screw *E*, so that the disk is forced out as the feed lever is thrown back.

Some of the trepanning tools are shown in Fig 10. It will be observed that a thread is machined on the shank which fits into a tapped hole in either the sliding or fixed spindle. When using a set of these tools one of the smaller ones is screwed into the work or tail spindle and is merely used to hold the blank as previously mentioned. A larger tool is screwed into the rotating spindle. An advantage of this type of tool is that each may be used for either holding or cutting the blank according to whether it is fastened in the stationary or rotating spindle. In each case, however, the cutting tool is the larger in diameter of the two. The hole through which the push-out rod operates may be observed in the center of the tools.

Recess Cutting

The machine used for the recess-cutting operation is shown in Fig. 11. The blank is held in the wooden chuck *A*. The cutting tool *B* is flat in section and held by a setscrew as shown. The operator feeds the tool against the revolving blank and the recess is formed. Another view of the machine is illustrated in Fig. 12. The tool *A* is used when placing the piece in the chuck, the hook of the tool being placed in the split joint of the chuck, forcing it open enough to allow the blank to be put into position. When the tool is removed the chuck jaws spring together, thus holding the blank securely for the machining operation.

A number of chucks used for holding different shapes of blanks are shown in Fig. 13. It will be seen that these are made with a thread on the shank which screws into the spindle of the machine.

After the recess has been machined in the blank the next operation is forming the outside contour. This work is similar to some of that previously noted for other parts and depends entirely on the operator's skill and practice to obtain the correct shape, a formed grinding wheel without any fixture being used.

More About the Modern Foreman

By James H. Follen

After reading the article by E. Andrews page 661, Vol. 49, of the *American Machinist*, on "The Modern Foreman—What Is His Present Job?" and noting the list of requirements necessary it was refreshing to read the criticism by Harry Senior on page 1008 of the same journal.

One reads a lot of bunk about "born disciplinarians" and men who rule with an iron hand, etc., but when you really meet up with a foreman who is successful with his men you will generally find him to be what is known as a "regular fellow." To one with years of experience in handling men the fact is evident that a successful foreman's greatest qualification is adaptability.

While the superintendents or plant managers are, of course, the responsible heads of their shops, nevertheless the foremen, who are the ones that come in actual contact with the workers, are vital factors in making the shop a success or a failure. Many times a man possessing the adaptability that will enable him to best coöperate with his men, each of whom presents a different problem, will prove more successful than a man without this adaptability but who actually knows far more about the work to be done.

This calls to mind a story I once heard of a machine builder who, having grown old in the game, retired from active business and left the direction of the plant to his two sons. In the course of time the boys found it necessary to appoint a superintendent and, desiring to reward faithful service, concluded that it would be good policy to promote one of their foremen, but they could not agree on which one.

Appointing the Superintendent

One of the boys was in favor of giving the new job to the foreman of the lathe department, who was the finest lathe hand and best producer they had ever had. The other partner was partial to the foreman of the erecting department, averring that the knowledge of detail possessed by him would be of greater advantage to a superintendent than that of a machine hand.

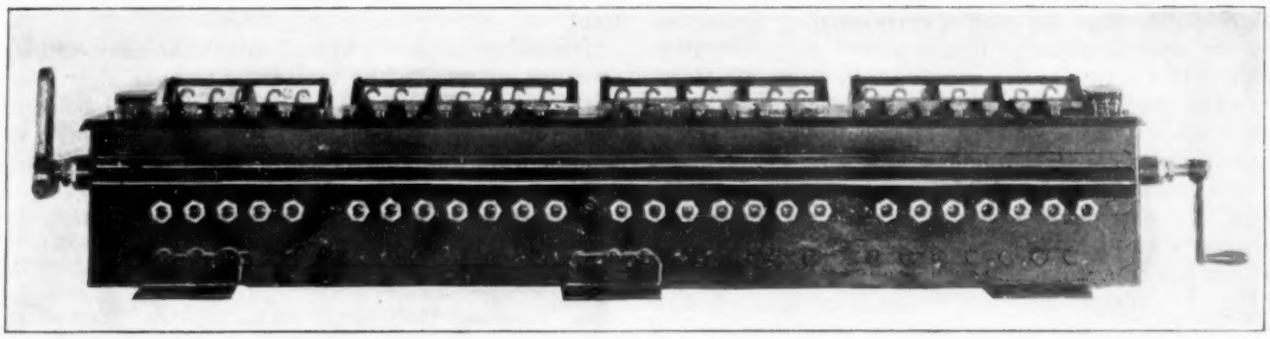
As they could not reach an agreement they took the matter to the "old man" for advice. Each of the boys expatiated upon the superior qualifications of his particular candidate, and in their zeal to back up their own judgment made an exceptionally good case for the two foremen. The old man listened attentively to the summing up and rendered his decision as follows: "Boys, you are both wrong. Better keep Bill in the lathe department, as he seems to have found his element there; also since Joe can work such wonders on the erecting floor, that is the place for him. Any damn fool will do for a superintendent."

Requirements for a Foreman's Job

While the foreman's job does not require quite all of the virtues noted in Mr. Andrews' article, if a man *could* be found carrying around that awful bundle he no doubt would be a "crackerjack," but it would be pretty hard to keep him a foreman; he would doubtless buy out the plant in a few years and hire the former boss to run it for him.

However, there is no danger. The only sure thing in the world besides death and taxes is the fact that sooner or later we all find our level, which is determined by our possession or lack of possession of the qualities that make for success. No one man has them all; if he did he'd be simply unbearable.

The whole article makes me think of the man who wrote to the editor of a paper asking him to find him a wife, saying she must be about 28 or 30, good looking, have a good figure, a kind and loving disposition, be a good cook and housekeeper and have none of the new-fangled ideas about woman's rights; also, while it was not exactly necessary, it would add to her attractiveness if she had a little money of her own. The editor (who happened to be a bachelor) replied saying he would try and find such a woman, but if he was successful in his search he would marry her himself.



Manufacturing a Mechanical Lubricator—II

BY M. E. HOAG

In the making of mechanical lubricators it is necessary to join many parts permanently, and for this work the electric-welding process has superseded riveting, bolting and brazing for the reason that it will not only produce a more satisfactory and permanent joint than will even the most expensive of the discarded methods, but in point of cost is far below the cheapest of them.

IN ORDER to weld metal parts successfully it is often necessary to change their forms slightly to secure ample contact at the point of welding, and neglect to do this is frequently the cause of failure that is too often blamed upon the welder. An example of this is shown in Fig. 8, which shows the eccentric ring, or strap, used in the Kipp lubricator. The ring *A* is first drilled, reamed and cut off from 1½-in. screw stock in the automatic; then the trunnions, which are also screw-machine products, are welded on. It will be noticed that quite a heavy shoulder is left on these at *B* in order to bring the contact down near the point of welding, as otherwise the entire piece would be heated and when pressure was applied the ring would be distorted.

No jigs are used for this work, but the ring is slipped over the lower copper contact, which is round and about the same diameter as the inside of the ring. The workman then sets a trunnion on top of the ring, gaging its location by his eye, and brings down the upper contact, which is hollow, contact being made on the heavy flange *B* and the weld made. The piece is then turned over and the operation repeated. Under ordinary conditions a workman will turn out 2200 of these, or 4400 welds a day. All of the welding in the Madison-Kipp shops is done on Toledo and Thompson welders.

After welding, the trunnions are straddle-milled to remove the overhang of the shoulders, and they are then brought to size by hollow-milling on the special machine shown in Fig. 9, which leaves them as shown at *C*, Fig. 8.

The machine, shown in Fig. 9, carries two hollow mills *A*, which are driven by belts as shown. The handle *B* of the upright *C* raises up and allows the ring to be slipped over it and down onto the base *D*. A split washer is then slipped on, engaging a shoulder on the piece *C* which screws into the base *D*. A slight turn of the handle clamps the ring in place. The trunnions are located by the gage *E*, which carries two

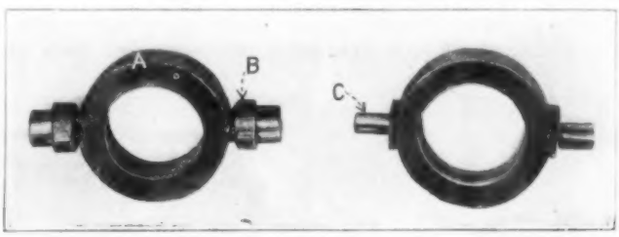


FIG. 8. ECCENTRIC RINGS WITH WELDED TRUNNIONS

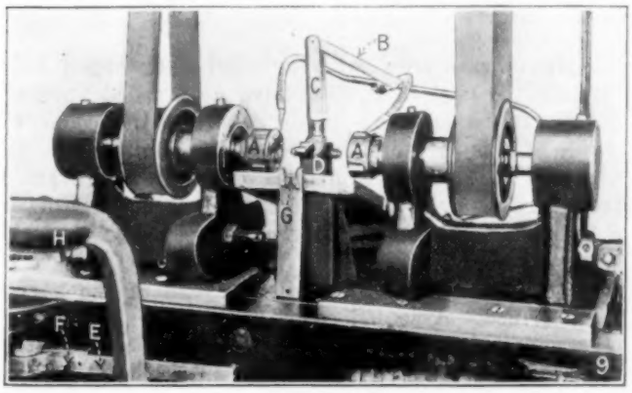


FIG. 9. HOLLOW-MILLING TRUNNIONS

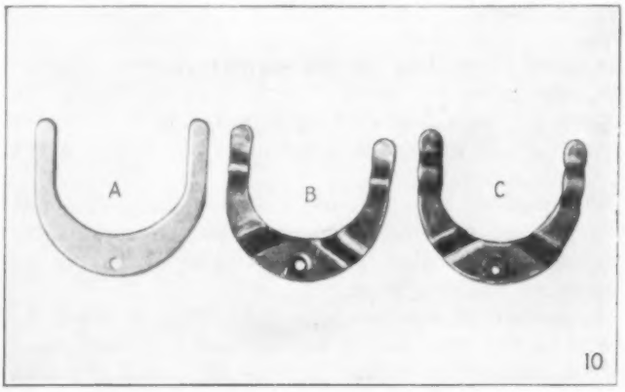


FIG. 10. THE ECCENTRIC-YOKE PARTS

notched forks at one end to engage the trunnions. A third notch at *F* fits over a corresponding projection in the upright piece at *G* and locates it, where it is held until the ring is clamped firmly in position. Movement of the lever *H* forces the mills together until they come against stops which determine the length of the milled portion of the trunnions.

The yoke is made of two punchings as shown in Fig. 10. The pieces are first blanked out as seen at *A*, and a small hole is pierced. The pieces then pass to the second stage of the tool, where a drawing punch enters the pierced hole and draws it up into a hollow cup to form a bearing as seen in the two pieces *B* and *C*. The two parts of the yoke are connected together by a small steel piece which has an opening at its center for the purpose of attaching it to the end of the pressure plunger. The steel bushings shown at *A*, Fig. 11, are placed on the trunnions of the eccentric ring; the steel piece above referred to is entered in the openings in the yoke, the two halves of which are then closed down and spot-welded at the points *B* and *C* on each side, thus binding all the parts firmly together.

The Case, or Tank

The tank is made from sheet steel 0.065 in. in thickness. The steel is first sheared to size and then passed through a series of rollers which turn down a flange at right angles to the sides as shown in Fig. 12. A set of punching dies blank out the openings *A* and *B*, and another die is used to cut out triangular pieces from the flange to form the corners. A very ingenious adjustable die pierces a series of connection holes, after which the case is formed up on horning dies.

This brings the case up to the welding operations, which consist of spot-welding a reinforcement back of the seam *C*, welding in the support *A*, Fig. 13, for the gage glass, the piece *B*, two brackets *C* and the bottom *D*. In a four-feed lubricator this will require from 15 to 20 welds, and a workman will handle about 400 tanks a day.

The welders have in some instances been equipped with two sets of contacts, which enable the workman to complete the welding of a tank without having to change or readjust them.

A number of schemes have been tried to weld the seams of the case, but so far nothing has been found so satisfactory as soldering. As all parts are held firmly together by the welds there is no strain on the soldered joint, and it renders the tank absolutely oil tight.

The barrel of the sight-feed lubricator has two long openings to receive the measuring-plunger sleeve and the pressure plunger besides numerous small holes or ports, all of which must be drilled and some of them tapped, while the plunger holes must be reamed accurately to size and tapped to take closing plugs. As stated before, there are some 40 operations on this one piece, many of which require the use of cleverly designed and accurately constructed jigs and fixtures.

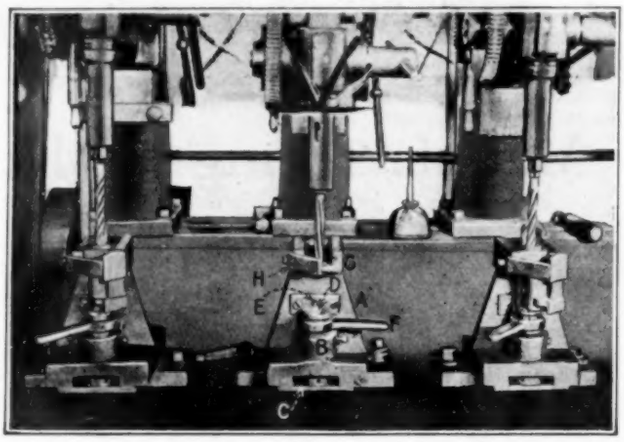
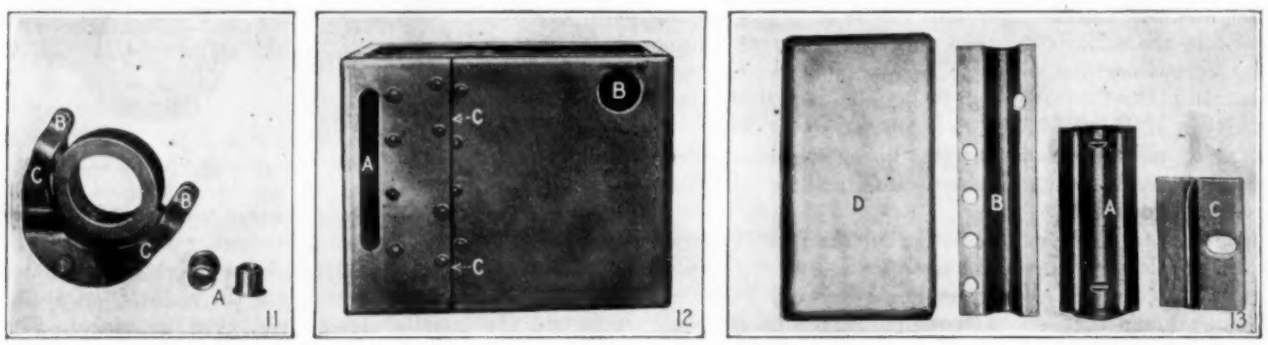


FIG. 14. DRILLING JIGS FOR THE BARREL

The first operation shown is drilling and reaming the plunger holes. For this work the jigs shown in Fig. 14 are used, and owing to the speed with which they can be loaded and unloaded one workman is able to handle several at a time. The empty jig shown at *A* gives a good idea of their construction. The body of the jig is cast iron, with a bored and tapped hole through the portion *B* to receive a threaded bushing which can be adjusted up or down by the collar *C*. Inside of this threaded bushing is a second bushing *D*, which is free to move up or down, but is prevented from turning by a key in the steel plate *E*. The lever *F* is free to turn on the top of the large bushing and has a lifting action on the bushing *D*, which is coned out at the top to receive the end of the barrel to be drilled. A second coned bushing in the support *G* receives the other end of the barrel, and as the lever *F* is swung to the left it raises the lower bushing, clamping the barrel firmly between it and the upper



FIGS. 11 TO 13. A FEW OF THE VARIOUS PARTS
Fig. 11—Eccentric ring and yoke assembled. Fig. 12—The tank after spot-welding. Fig. 13—Parts of the tank to be welded into place

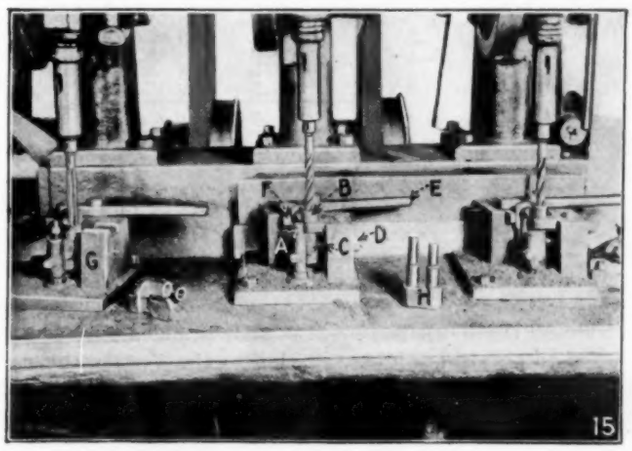
one. A block *H* engages the flat portion of the barrel and prevents it from turning during the drilling operation as may be seen from the loaded jigs. The drilling machines used on this work are equipped with power-feed and automatic knockouts which enable the workman to handle a large number of pieces a day.

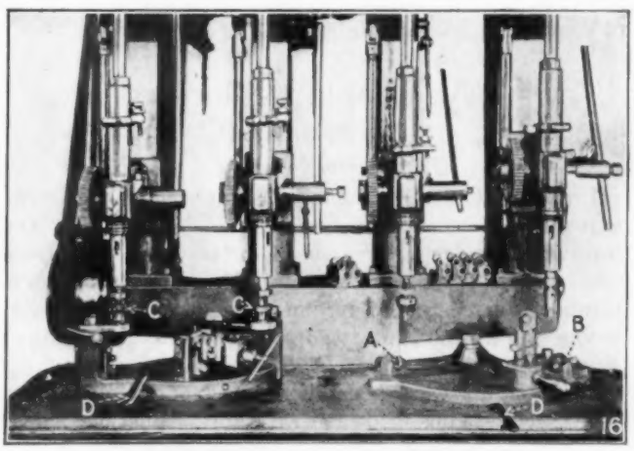
Besides the machine-reaming done in these jigs the plunger holes are hand-reamed twice, which insures uniform size of holes.

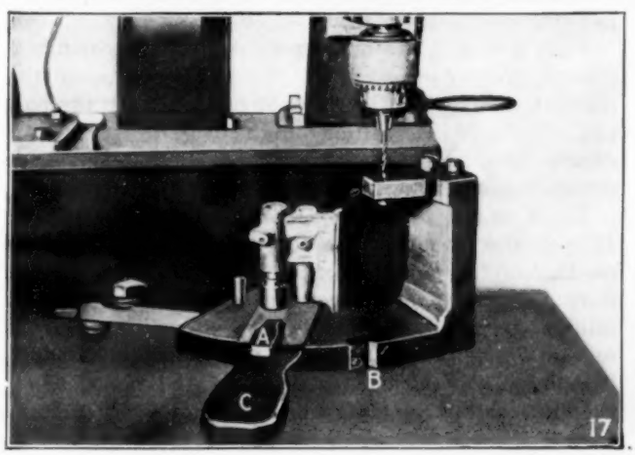
The second plunger hole is drilled and reamed in the jigs shown in Fig. 15, which are somewhat different than the ones for the previous operation, but are equally simple and speedy in operation. In these jigs the location is taken from the hole already drilled and reamed, the piece being slipped onto the hardened plug *A* and then swung under the bushing *B* against the stop *C* on the end of the screw stud *D* where it is held in place by a movement of the lever *E*, which forces a hardened-steel wedge against the piece to be drilled. The reaming jig *G* is the same as the drilling jigs except that the piece is allowed to float instead of being held rigidly. As each piece is finished it is tested with the gage *H*, which carries two hardened and ground plugs properly spaced to insure correct size and proper spacing of the holes.

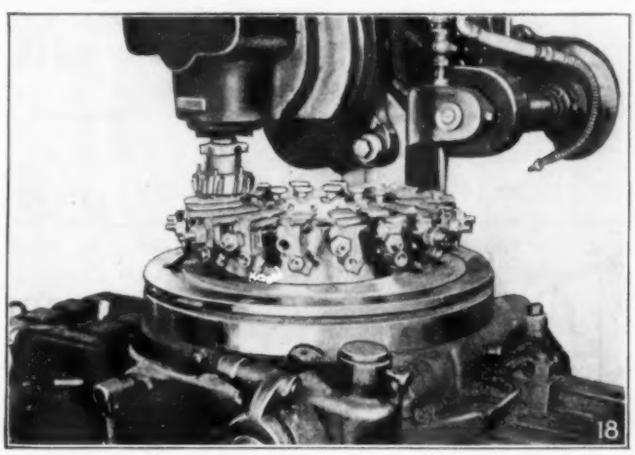
Both ends of the barrel are faced to length in the swinging jigs shown in Fig. 16. These jigs are simple in construction and rapid in operation and a number of them are used for various drilling and tapping operations. Swinging the jig to the right brings one hole under the facing tool and to the left brings the other hole in line, adjustable stops being provided as shown at *A* and *B*. When one end of the barrel is faced to length it is transferred to the second jig and the other end faced. The facing tools are fitted with adjustable stops *C*, and the work is held to gages which are shown at *D*.

A close-up view of one of these swinging jigs is shown in Fig. 17. This jig is used for drilling a small cross-connection hole. Proper location is secured in this case by an index plunger *A* which drops into a notch in the steel insert at *B*. The index pin is held in place by a spring which is strong enough to insure proper indexing but allows the handle *C* to be moved in and out of position without withdrawing the plunger *A* by hand, which greatly increases the speed with which the work can be handled. This operation is performed by women who operate two jigs at once, the drill spindles being equipped with a foot treadle which allows both hands to be used in loading and unloading the jigs.









FIGS. 15 TO 18. OPERATIONS ON THE BARREL

Fig 15—Second drilling jig for the barrel. Fig. 16—Facing the barrels to length. Fig. 17—Swinging drill jig for the barrel. Fig. 18—Circular milling fixture for the barrel

Throughout the shops the speed of the work is limited only by the machining time, the jigs and fixtures being so designed that the loading and unloading time is a secondary consideration.

It has probably been noticed that in handling the barrel the sequence of operations has been reversed according to general practice, which would be to mill the

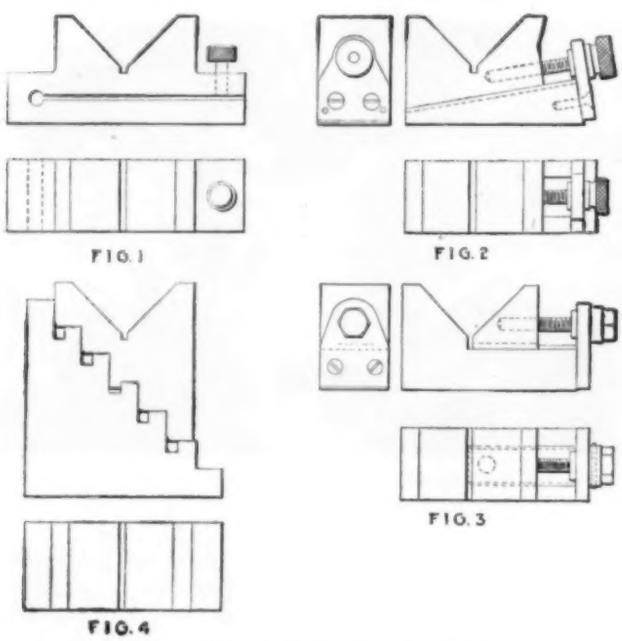
flat surface of the bracket first and then locate from this. Such a procedure would, tend, however, to produce holes eccentric with the outside of the barrels and would offer greater difficulty in locating properly. The methods here followed insure perfect alignment of the holes with the milled surface on the bracket and also insures their being concentric with the outside. In the milling operation location is taken from the drilled and reamed holes as seen in the circular milling fixture shown in Fig. 18. This fixture is very simple in construction. Two hardened studs receive the barrel and locate it, one stud being threaded and provided with a nut to bind the piece in position during the milling operation.

The next article will describe the measuring sleeve and plunger together with some very clever and unusual dies used in making them. A description will also be given of the adjustable die used in punching a series of connection holes in the tank.

Adjustable V-Blocks

By W. G. Hill
London, England

I was prompted to submit the appended details of adjustable V-blocks because of the service they are capable of rendering when used for inspection purposes or as an aid in general mechanical and toolroom work. However, they are not recommended for use in rapid-production work. I fully realize the advantages obtained by the use of permanent and absolutely fool-proof jig fixtures. This word adequately describes many of the devices now being made to facilitate production, which



FIGS. 1 to 4. ADJUSTABLE V-BLOCK
Fig. 1—V-block with slight adjustment. Fig. 2—The inclined-plane type. Fig 3—One with a sliding jaw. Fig. 4—The step-up type

cannot justly be termed jig or fixture, but can be termed jig fixtures as they perform the functions of locating the operating tools and also of securing the articles operated upon. This will be apparent if one inspects the production department milling machines of today.

The illustrations given cover many of the requirements in adjustable V-blocks. The testing of small crankshafts and camshafts, with their varying end diameters, will form examples in which adjustable Vs can be used to advantage. It is of course understood that the blocks are made in pairs to be used together. Fig. 1 illustrates a V that is made of cast iron. The

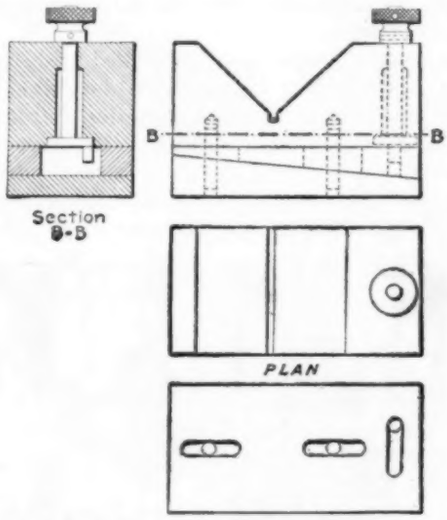


FIG. 5. A WEDGE ELEVATING TYPE

body of the block is sawed as shown and a setscrew is used to obtain a slight elevation to the V. As the rise and fall can act only with the spring of the metal it will be obvious that the lift given by a small V may not exceed 0.003 in. The rigidity of the block, however, in precision work is a point of note.

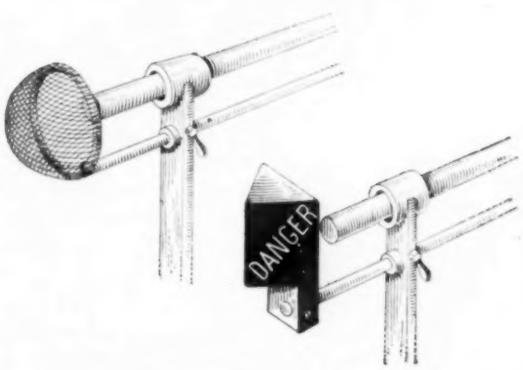
Figs. 2 and 3 are similar in design but capable of a much greater adjustment. It may be mentioned that the male V-slide on Fig. 3 is not integral with the base, but is secured in position on the base by screws and dowels, this method being adopted to obviate delicate machining operations.

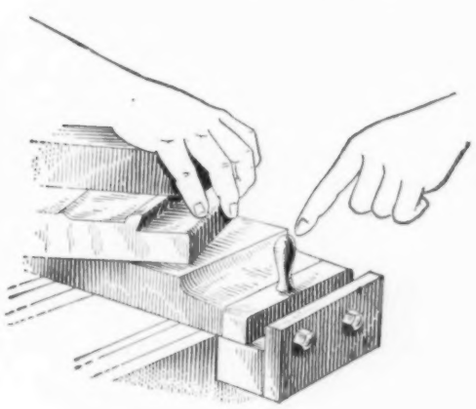
The V in Fig. 4 can only be elevated in definite steps. It is used with advantage for the setting out of work on the surface plate, resting work on the lathe bed during the change of operations, or on a drilling or milling machine. The middle keeper toe on the top half of the V gives a positive lock, preventing any slipping that might be occasioned with undue vibration.

Fig. 5 shows an adjustable V elevated by a sliding wedge, which is actuated by an eccentric operated by the knurled head. The pins indicated are secured into the upper V; they pass through the moving slide and anchor the base in true relation to the upper half of the block. The bottom view which is a plan taken on the line *B* shows the slots and keeper studs which allow motion of the V-slide in a longitudinal direction only. The lateral slot in which the crankpin operates gives the necessary rise and fall, or elevation, to the V, and a light spring washer is placed under the knurled head to keep it in tension, while a small roller fitted on the crankpin serves to eliminate friction. The two last-mentioned details are not shown, as their utility will be quite clear. It will be found that these V-blocks are very handy for many jobs that would otherwise be rather troublesome if special jigs or fixtures were not at hand.

CURES *for* COMMON SHOP COMPLAINTS

By J. A. Lucas





Diseases and Infections

By CHESLA C. SHERLOCK

Many occupations give rise to special diseases which are caused by conditions peculiar to the occupation and which are known as occupational diseases. Some courts hold that such diseases in themselves furnish ground upon which to base a claim for compensation, though other courts require evidence to show that incapacitation or death from such disease is aggravated or hastened by such minor injury.

WORKMEN who follow certain lines of employment often contract diseases peculiar to that employment and which are known as occupational, or industrial, diseases. It seems that the frequency of these diseases is becoming more apparent as our industrial life becomes more complex, and it is also apparent that there are few occupations in industrial life which do not have their diseases.

The first workmen's compensation acts in this country omitted the mention of these diseases. This was perhaps an oversight, but the fact was that all diseases were clearly dropped out of consideration by the limiting words of the act. Recovery of compensation was predicated upon "an injury by accident" arising out of and in the course of the workman's employment.

Since our acts were largely taken from the English act, our courts have followed the English interpretation, and we find that across the water they were of the opinion that an occupational disease was not an "accident," therefore a workman suffering from such a disorder was not entitled to compensation regardless of the merit of the case.

The fact that a workman is suffering from an occupational disease is generally evidence that he has been in the employment of his employer or others in the same work over a period of years. The ordinary occupational disease does not arise suddenly, it is the result of long association in a work which is injurious to the health.

Workmen are given compensation because there is a legal presumption that they have been contributing something to the wealth of society by their labor. When an accident arises, the law says that the workman shall be protected from total loss by the payment of compensation. But the same arguments apply to the workman who has contracted an occupational disease. The chances are that he may have contributed something more to society than the fellow who is injured by accident, yet the law throws the mantle of protection over the latter.

Why this discrimination? It is due, I think, to a technicality, and nothing else. In states where the wording of the act has been more favorable the courts have included occupational diseases in the list of compensable injuries. In Massachusetts the law allows compensation for "personal injuries," and the court has said that an occupational disease is a personal injury. Other states have by express legislation made arrangements to take care of this class of industrial losses.

The distinction is one of technicality, for the great majority of students and courts agree that there is no fundamental difference between a sufferer by accident and one by disease. If the one is protected so should the other be.

Employers often raise the objection that if legislation were enacted to take care of occupational diseases they would in time be forced to deny employment to workmen having such diseases. It has been said that employers would use a man until he commenced to show the first symptoms, then he would be turned away and would not be able to find employment again because employers would refuse to stand the loss under the statute.

This might appear to some to be a valid objection and that it would be better for the sufferers to be left in their present position where they can earn a livelihood until the disease incapacitates them than to have thousands turned out of employment, many several years before their usefulness to themselves has been lost. But the Iowa Industrial Commissioner has said in a decision that he has no such fear; that he has too much confidence in the good faith and honesty of the American employer to believe that he would stoop to such tactics. Doubtless the majority of employers would not resort to such tactics, but it remains to be seen. It might be pointed out that it is not an easy matter to escape liability under any form of contemplated legislation. If the legislative authority observes that certain legislation is defective it has only to revise such legislation and impose a penalty upon those who seek to evade its plain intent.

If employers did establish medical examinations for their workmen and discharged all who showed symptoms of occupational disease it would only be a short step for the legislative authority to amend the law and fix a penalty for all who turned away such workmen when they showed symptoms of becoming a liability to the employer. So much for the objections to occupational-disease legislation. In the meantime it is possible only to apply such law as we have and to hope that it will not be long before this class of sufferers will have as adequate protection at law as those injured by accident.

Purely occupational diseases are not compensable unless the statute expressly makes them so or unless recovery is not based upon an injury by "accident." The overwhelming authority is against the proposition that disease, at least occupational disease, can in any way be classed as an accident.

In Illinois there is a statute known as the Occupational Diseases Act, which specifically treats of cases falling under this heading. A case arose under that act where a workman had been employed in a forge room for four or five days prior to the injury. It was the duty of the decedent to feed a furnace. The temperature of the room was between 85 and 90 deg. at the time he was rendered unconscious. Half an hour later he died.

There was a conflict in the testimony as to what, if any, devices could have been used to reduce the tem-

perature of the workroom, but it was shown that the temperatures mentioned would affect but slightly a normal man. It was also shown that just before the death of the man there was a flow from his mouth which had the odor of whiskey and that in his pocket there was a flask containing whiskey. The verdict of the coroner's jury was that death was due to "organic heart disease combined with isolation," but the attending physician had testified that death was due to apoplexy.

Judgment had been rendered for $3000 for decedent's dependents, but the court reversed the judgment of the trial court, saying that the death was not an "accident" within the meaning of the workmen's compensation act, and that it was insufficient to show that the death resulted from any violation of the Occupational Diseases Act, the true cause having been apoplexy.

An Ohio Case

In an Ohio case decided in 1915 the claimant contracted lead poisoning while employed by a manufacturer of white lead and became incapacitated. He was denied compensation by the Ohio Industrial Commission. He then brought the matter to the attention of the courts and was rendered compensation. The Supreme Court reversed the judgment saying that occupational diseases were not within the contemplation of the statute. Said the court: "It is no difficult matter to bring within the purview of the words 'personal injuries sustained in the course of the employment' occupational diseases incurred in the course of the employment. It can further be conceded that had the legislature, in enacting either the original or the present law, desired to make plain its intention to exclude occupational diseases from participation in the fund, the exclusion could really have been made by adding to the words 'personal injuries' the qualifying phrase 'by accident.' As against all this the court feels impelled to follow both the executive and legislative construction of the word 'injury' as employed in the act, and to limit recovery of compensation to such as may have suffered injury otherwise than through disease, thereby giving the legislative and executive construction the added force of judicial construction."

Later, in the same opinion, the court recognized the fact that there is really no reason why occupational diseases should not receive the same attention that injuries by accident had received. Said the court: "The victims of modern industrialism springing from disease incident thereto are only less numerous than those arising from pure accident, and no sound policy can be suggested that should protect the one class and ignore the other, especially when the compensation system becomes firmly established. Until this is done the court will continue to construe the law as it was obviously intended by the legislature that it should be construed."

In a Massachusetts case a printer contracted lead poisoning. Said the court: "There is nothing in the evidence or elsewhere in the record to show what was the composition of the type upon which he worked. Nor is there anything to show that lead fumes or lead dust or any dangerous compound of lead is given off in a printing office or in such handling of type as that engaged in by the employee to such an extent and in such form as to be likely to be taken into the human system and to cause plumbism. While it is quite possible that such may be the fact we do not know it, and in our opinion it cannot be regarded as a matter of common knowledge."

In another Massachusetts case it was shown that a lead grinder 73 years old, who had followed the same occupation for more than twenty years was suffering from plumbism. The court was of the opinion that this was a "personal injury" within the act and allowed him to recover compensation.

In a California case the plaintiff was employed in a mill, sacking grain. He became afflicted with an infection of the nose and mouth known as actinomycosis, which partially disabled him. The court said: "The evidence taken upon this issue was that of expert witnesses as to the nature and causes of actinomycosis and whether it was or could be conveyed by grain to the human organism. Upon this subject the testimony of physicians was in conflict, as were also the medical treatises upon which they respectively relied for their opinions. The commission resolved the doubt and conflict in opinion and authority in favor of the applicant for compensation by its finding that 'the applicant's employment in and about the handling of grain caused him to contract the disease known as actinomycosis.' The evidence in support of this finding consists not only in the opinion evidence of the physicians who treated the applicant and diagnosed his case, but also the testimony of the applicant himself that he had not heretofore suffered from any such disorder, but that it had become actually developed while he was engaged in the work of sacking and handling pulverized grain for his employer. We think this evidence was sufficient to warrant the commission in arriving at its aforesaid conclusion, and this being so we have no power to interfere with its discretion in making said award." This case was decided in 1917.

Actinomycosis is not peculiar to any particular employment, but may arise anywhere the air is filled with dust particles.

A Case of Anthrax

In New York the plaintiff contracted anthrax while handling diseased hides. He was awarded compensation by the Industrial Commission and the matter was appealed to the courts. The New York statute allows recovery for: "Only accidental injuries arising out of and in the course of employment and such disease or infection as may naturally and unavoidably result therefrom." The court affirmed the award of compensation, saying: "There is a broad distinction between the present case and the case of an occupational disease. The latter is incidental to the occupation or is a natural outcome thereof. . . . This disease incurred by the claimant was unexpected, unusual and extraordinary, as much so as if a serpent concealed in the hides had attacked him. There is no difference in principle because the attack, instead of being made unexpectedly by a concealed serpent, was made unexpectedly by a concealed disease germ. There seems to be no question in the case but that the claimant contracted the disease in the manner and under the conditions above indicated. We think the circumstances constitute an accidental injury within the meaning of the statute. However, there is another theory upon which this award may be upheld. The claimant in the course of his employment and as a result thereof had received an abrasion on his hand or a

fissure therein. This may properly be deemed an accidental injury arising out of and in the course of his employment, and the disease or infection caused by the anthrax germ may be deemed 'such disease or infection as may naturally and unavoidably result' from such injury within the meaning of the statute." This case was also decided in 1917.

Excluded Diseases

All diseases and infections are not excluded from participation in the workmen's compensation acts. If a disease or infection is clearly of the class known as occupational diseases, then no recovery can be had unless express provision is made for it in the statute or unless the particular state court construes the statute to include it. But certain diseases are treated as compensable injuries under the most stringent compensation acts, and we daily find the courts awarding decisions to workmen who become incapacitated by disease. There is a test announced by the courts which may generally be applied correctly. It is this: Did the disease or infection result from an accident or was it in the nature of an accidental injury? We saw the New York court apply this test in the anthrax case aforementioned and we found that the workman recovered compensation. It is a common occurrence for men handling hides and pelts to suffer from anthrax and in some quarters it is even considered an occupational disease. Yet the manner in which it arises may change it from the noncompensable to the compensable class.

It is generally decided in this country that if a disease results from an injury, even though it be an occupational disease, that it is compensable. This is because the injury and not the disease was the proximate cause of the incapacity. In like fashion if a workman is suffering from an occupational disease, but sustains an injury by accident which aggravates the disease so that he is incapacitated he is entitled to compensation.

Again, a disease may take on the nature of an accident. We frequently find the courts awarding compensation where the workmen contracted pneumonia while at work. This is not a far stretch of the imagination. If a disease can under extraordinary circumstances take on the nature of an accident there is no valid reason why compensation should not be paid. It must be recognized, however, that this will be true only under unusual conditions.

We have now considered the more important phases of the workmen's compensation acts and special legislation on the subject. Let us consider briefly the common law on the subject as it stood prior to the compensation acts and as is stands today in states that have no compensation legislation.

A Missouri case, which was decided in 1916 under the common law, showed that a minor was employed as a day laborer to carry away boards that were taken from the floor of a box car that had been used in carrying cement and which were covered with cement dust. The dust was blown in the plaintiff's eye, and the caustic poison that the dust contained formed an ulcer which destroyed the sight of the eye. The plaintiff asked damages, alleging negligence on the part of his employers for failure to provide him with a safe place in which to work and in failing to warn him, being young and inexperienced, of the special danger to his eyes from the dust, of which danger the employers were charged with being or ought to have been aware. The employers claimed that the eye might have been affected by germs, independent of cement dust, and argued that the cause of injury was so problematical that the jury could not rightfully say that it was due exclusively to the dust. Said the court: "Lime and cement which contain a poison of particular malignance to the tissue and structure of the eye are commonly carried by railroads so frequently and in such quantities that their injurious properties must have been known to the defendants. It is the duty of mastership to exercise reasonable care to provide the plaintiff a reasonably safe place in which to work, and the jury were entitled to infer that the defendants should have known that the boards were covered with the poisonous dust, and that to set an inexperienced laborer to work where the dust would be blown into his eyes added a very serious danger to the hazards of his service. Not to warn him of such danger was an act of negligence for the consequences of which the master should be held responsible."

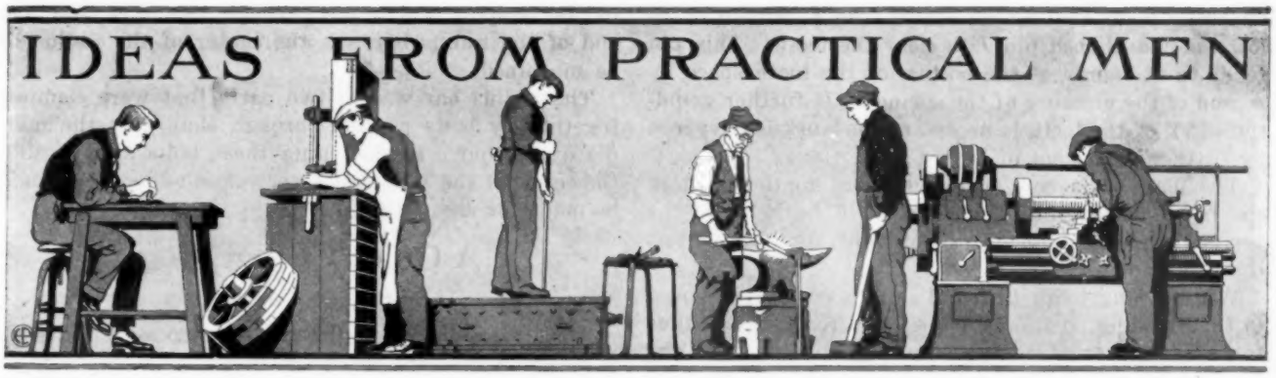
In an Illinois case the court said: "It is a matter of common knowledge that cement is now one of the most generally used materials in certain trades and industries; that it is packed in bags or barrels from which the cement is usually taken just as it is needed for use; also that it is a light, powdery substance which easily floats through the air; that there is nothing in its composition or ingredients which causes the use of it to be accompanied with such special danger that would require it to be handled different from other building materials of like character for the protection of persons engaged in the work." And the Illinois court held that the injury was due to an accident and not to the negligence of the employer in the manner of handling or failing to warn, thereby taking the opposite view of the Missouri court.

Showing Negligence

Under the common law in order for a workman to recover from his employer for a disease or infection he must show that it is the result of the negligence of the employer in (1) failing to provide him with a safe place in which to work; (2) with reasonably safe tools and appliances, and (3) failure to properly warn him of the danger of his employment if he is inexperienced or has no means of ascertaining the danger for himself. In order for the plaintiff to recover he must show above all else that the employer knew the dangers of the work or must have known them from his experience in the business. It is good law to say, under the common law at least, that an employer cannot be charged with knowledge of something that he does not know and of which he does not have the means of knowing. And unless the workman can show that the employer knew or must have known his claim will fail.

Diseases and infections are playing a more important part in our industrial affairs. It is not making too extravagant a claim to say that they will demand more attention in the next few years than they have had before and that they deserve more attention.

This is a class of industrial loss which will have to be given serious consideration by our courts and legislatures in the near future if substantial justice is to be done to the laboring classes. If the principles of our compensation system are to survive we must provide for the sufferer of occupational diseases.

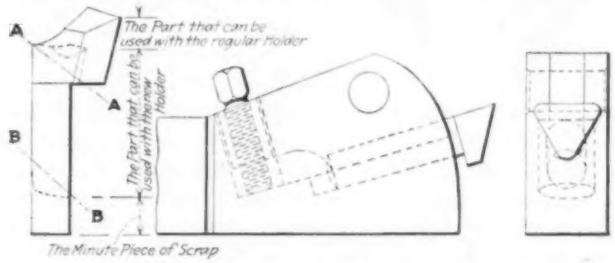


A Tool Holder for Using Up Worn-Out O.K. Tool Bits

BY E. H. KREIDER

Having accumulated a stock of worn-out high-speed-steel tool bits of the well-known O.K. type as a matter of economy I made a toolholder that will use them up to the limit. While the design is only in part original with me I find some very convenient points about it that I have not seen in other holders.

In the diamond-point tool here illustrated will be seen



HOLDER FOR USING UP WORN-OUT TOOL BITS

the part that can be used with the regular holder, after which it is ground off at *A* and inserted into the new holder as shown, where it can be used until only a minute piece of scrap remains as at *B*.

The cylindrical shank by which the tool is held can be left free and can be turned in the holder, thereby throwing the rake and clearance from side to side, making right and left tools out of the same bit without grinding the metal away.

Device for Gaging Cutters While Grinding

BY JOHN MILES

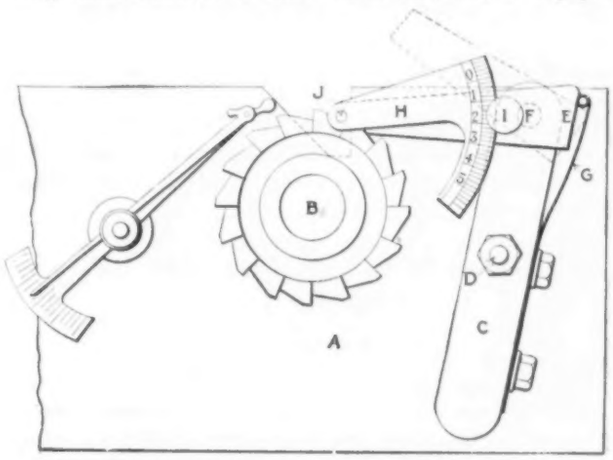
The sketch shows a device to be attached to a cutter-grinding machine for the purpose of grinding gear-tooth cutters correctly and for gaging and correcting such teeth as may be in error.

The plate *A* supports the cutter to be ground, which fits over stud *B*. This plate or the table to which it is fastened must have a movement to and from the center of the wheel, and the center of the stud *B* must be brought into alignment with the face of the grinding wheel and secured against movement in a direction parallel to the wheel spindle.

A piece of ⅜-in.-square cold-rolled steel is attached to the plate *A* by the stud and nut *D* in such manner that while it may swing around *D* it may be held firmly in whatever position desired by tightening the nut.

A plate *E* about ¼ in. thick is pivoted upon *C* at *F* and tends to remain in one or other of two positions (as shown in dotted lines) by reason of the pressure of spring *G*, which is attached to the side of *C* by two screws.

A graduated sector *H* that can be fastened in any po-



DEVICE FOR GRINDING GEAR-CUTTER TEETH

sition within the length of its graduated surface by the knurled screw *I* is pivoted to the swing plate *E* by the stud *J*, which is riveted firmly to sector *H* and the lower end of which, projecting through *E*, is cam shaped, having a rise of about 0.06 within the limit of movement of the sector.

The indicator shown at the left is affixed to the table in such manner that its measuring point may be swung into the path of the cutter teeth and fastened while testing the tooth height.

With a cutter in place upon the boss *B*, the center of which has been accurately aligned with the cutting face of the grinding wheel, the cam-shaped lower end of the pin *J* projecting ¾ in. below the under surface of plate *E* rests in the tooth space back of the tooth to be ground.

The machine carriage is then moved forward until the wheel enters the tooth space of the cutter and the tooth face brought into contact with the wheel by moving the outer end of lever *C*. It will be seen that whatever this movement of the cutter may be, the tooth face will remain radial as the cutter revolves about the center of *B*, which is stationary in relation to the cutting face of the wheel.

When the first tooth has been ground sufficiently the nut *D* is tightened and the cutter is indexed around by

swinging plate *E* about its center stud *F* enough to allow the cam-shaped pin *J* to clear the teeth. This pin tends to fit snugly at the bottom of the tooth space by reason of the pressure of the spring *G*. If further grinding of all of the teeth is necessary the work is advanced by further movement of lever *C*.

The plate *E* is now swung outward to the position shown in dotted lines (where it will be held by the spring) and the indicator is brought forward to test the length of each tooth.

When a long tooth is found it is marked and moved to the grinding position. The sector *H*, which has thus far remained at zero, is released by turning back the binding screw *I* and the sector turned past two, three or more divisions as judgment may dictate, and again tightened. After grinding, the tooth is again tested with the indicator and the process repeated if necessary.

After one has used the instrument a short time a definite relation will be established in the operator's mind between the graduations on *H* and the corresponding reduction of the length of the tooth; the latter may then be made just right at the first trial. This relation would be very difficult to calculate, however, as it depends upon the amount of relief, which may vary with different cutters.

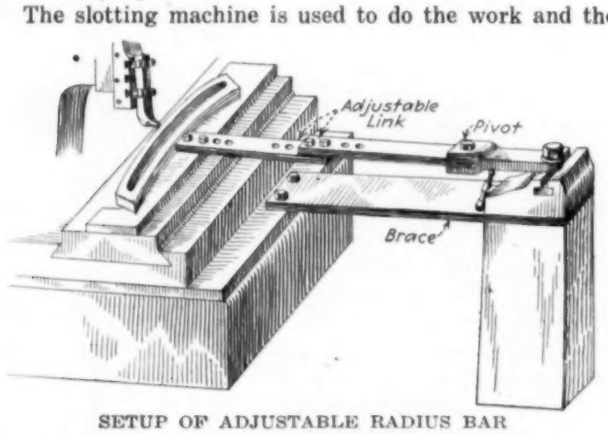
I have found that cutters may be ground to perfect concentricity by using this device much quicker than by the usual method of testing each tooth with a micrometer.

Adjustable Radius Bar for Planing Links

By Joseph Varhola

The sketch shows a slight modification of a well-known scheme for machining the reversing links of a marine engine when it is necessary to do this work in a small jobbing shop that is without special machinery for this purpose.

The slotting machine is used to do the work and the



SETUP OF ADJUSTABLE RADIUS BAR

feature to which I desire to call attention is the adjustability of the radius bar and the means provided for changing the center when adjusting for various radii.

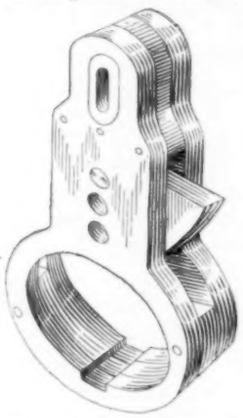
The circular and cross feed screws are removed from the slotting machine. A short piece of heavy timber is fastened to the floor at a suitable distance from the machine and on it is mounted the cross-slide of an old lathe that was out of service. A fork was made to go in the toolpost and a pin through this fork and one end of the radius bar was the center of the radius to be machined.

The radius bar was in two parts that were clamped together by bolts passing through slots near the middle of the bar. By loosening these bolts and turning the screw of the slide rest a very close adjustment could be made for any desired radius.

A Quick-Change Dog

By Leo Cohen

The device shown in the cut is intended for use on a grinding machine when there are large numbers of small pieces to be ground. It can be very quickly transferred from one piece to the next without the necessity for picking up a wrench or of transferring the loose piece of brass ordinarily used under a dog screw to prevent the latter from marring the work. It is made of two pieces of cold-rolled steel ¼ in. thick to form the sides, with fillers ⅜ in. thick at each end, leaving a slot of this width through the middle. A casehardened cam piece moves in this slot, being swung from a pin which passes through the side pieces. Three or more holes are provided for this pin to adapt the tool to different diameters.



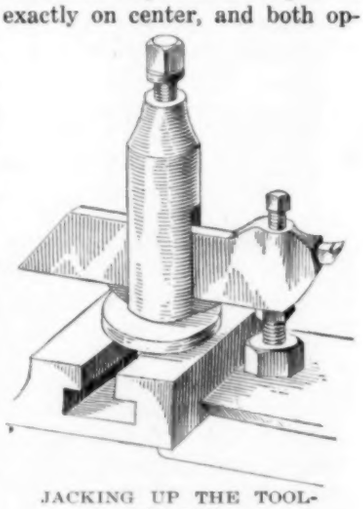
DOG FOR GRINDING MACHINE

An oblong hole is milled through the small end into which the driving pin enters to drive the work. The manner in which the dog drives the work is obvious.

A Scheme for Stiffening Cutting-Off and Threading Tools

By J. H. Spoor

Cutting-off and threading operations in the lathe are at best rather uncertain, especially if the material to be worked is machine steel. Both operations require a tool that is set almost exactly on center, and both operations are improved the more rigidly the bearings and slides are maintained. In either operation the tool is very liable to pick up a cut when it is not supposed to, and go to it with a vengeance that stops little short of a broken tool or spoiled work. When this work is to be done in a lathe with a compound rest, the little jack placed under the tool as shown in the cut will give it additional stiffness and aid the cutting action materially.



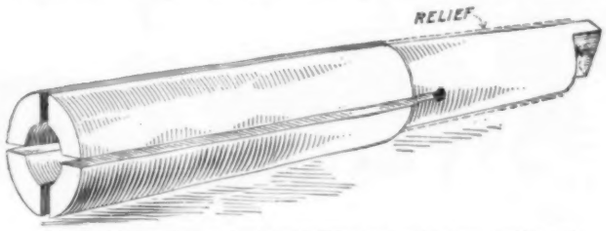
JACKING UP THE TOOL-HOLDER

Split Sleeve for Woodruff Cutters

By Oscar Craft

I have had some trouble in holding Woodruff cutters and have devised a scheme which I find to be much better than the drill chuck commonly used. This is a split sleeve made as follows:

Fit a taper sleeve to the collet that it is desired



SPLIT SLEEVE FOR HOLDING PARALLEL SHANK CUTTERS

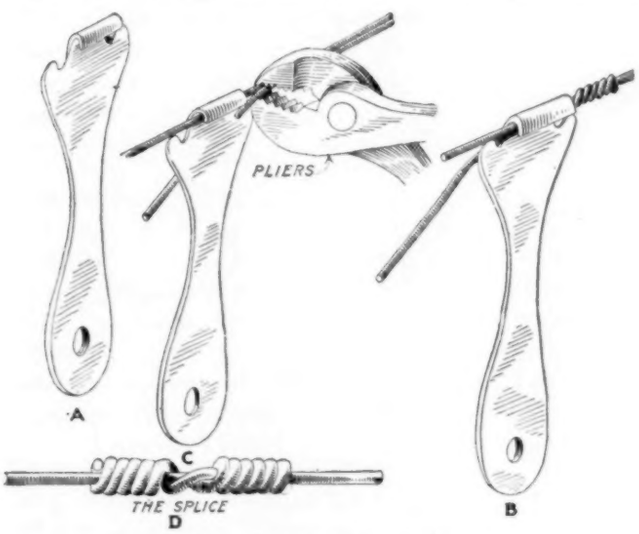
to use, and with it in place in the spindle in the milling machine carefully bore it to fit the shank of the cutter. Then with a slotting cutter make four cuts down the sleeve, as shown in the cut. The sleeve should then be relieved a trifle by slightly reducing its diameter between the bottom of the slots and the tang.

When the sleeve with a cutter in place is driven into the collet it will be held very firmly indeed. If desired a hole may be tapped in the small end, a hole drilled through the receiving collet and a draw bolt fitted, making it in effect a draw in chuck.

A Handy Wire-Splicing Tool

By Charles H. Willey

It is often necessary in the shop to splice the ends of two pieces of wire together, and when the wire is too stiff to be handled with a pair of pliers and the fingers such a tool as shown at *A* in the sketch will



TOOL FOR SPLICING WIRE

be found very efficient and handy. It is made of a piece of flat steel of ⅛-in. thickness.

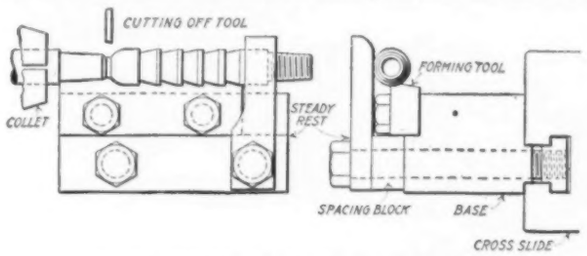
The two wires to be joined have their ends gripped parallel in a pair of pliers, and the tool used as shown at *B* to make the first seizing or winding. The splice is finished with the tool, as shown at *C*. The completed splice is shown at *D*.

A Steadyrest for a Screw Machine

By H. J. Gustave Kopsch

The cut shows a steadyrest which I designed for long, slender work in automatics and hand screw machines, and has given excellent service for months. It eliminates chattering, insures more uniform diameters on slender work, and does not interfere with tools in the turret or with operations such as drilling or tapping, which in some cases may be done at the same time as the forming operation.

The base may be used for many different shapes of forming tools if the two screw holes are properly located to have the forming tool rest against the shoulder. The steadyrest itself is hardened and polished on the bear-



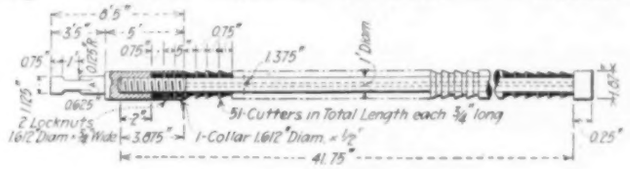
STEADYREST FOR SCREW MACHINE

ing surface. The main cause of dulling of the forming tool is the chattering of the work, and this is entirely eliminated. I have finished thousands of pieces at a much higher feed than before without regrinding the tool, and the security against the work riding up on the tool and the resultant breakage of drills, etc., is alone worth the slight expense of making it.

Any change in the diameter of the work is taken care of by simply using a thicker or thinner spacing block, as the case may be. This tool was first used on a Cleveland automatic, but it is useful on almost any hand screw machine. I believe it is a novel scheme, at least I thought of it only after having had much trouble with work of this kind, and I thought the idea might be of value to some of our readers who may have experienced the same trouble.

Long Built-Up Broach

Built-up broaches of the general design shown in the illustration are made in the shop of Armstrong, Whitworth & Co., Manchester, England. Any number of sections can be built up according to the work to be done. The cutting disks are of high-speed steel, each being ⅜ in. thick. These are assembled on a crucible-



LONG BUILT-UP BROACH

steel arbor, being positioned by a key and secured by a plain collar and two locknuts, the pulling end of the broach being also made of crucible steel and screwing on to the threaded end of the arbor as shown. The broach illustrated has been tested at cutting speeds ranging from 19½ in. to more than 50 in. per minute; sixteen blanks, for instance, were broached at a speed of 50 in. per minute without effect on the broach sections.

"WE'RE AGIN T

SOME months ago in New York City, and during the crowded hour on the elevated railroad, I saw two men form themselves into a human battering ram and thus gain toe room on the platform of the Ninth Avenue express. In so doing, they stepped all over each other, collided, impinged, bumped and otherwise impacted as is the necessity and custom.

Thus far the procedure was entirely regular. But what followed was not.

For the shorter and elder of the two, whose name was presumably Pat, took offense at the larger and younger individual, who was quite possibly called Mike, and thereupon burst into song.

I will omit the words of Pat's able effort and also the music, merely stating that it characterized Mike as "no gintleman, a wooden man," and one who ought to "fly for the Kaiser."

Mike, who had the appearance of a West End truck driver, evidently lacked in repartee, for he pondered this statement long and carefully. And then all unconsciously and unintentionally he gave birth to a psychological masterpiece of conciliation. "Fly for the Kaiser, is it? *Why, we're agin that gink!*"

Mike produced a common enemy and peace reigned once more on the platform. At the next station each of the former belligerents waited politely for the other to get off first.

* * *

There are plenty of common enemies on whom machine shops and machine-shop people of all ranks can unite without needing to resurrect the Kaiser. He's a dead one.

"We're agin the gink," for instance, who is a one-idea management fiend. The fellow who wants everybody else to do things the way he would do them if he ever did them.

These one-idea men started out to show Uncle Sam how to win the war—their way.

Their way consisted in following a certain ritual and constructing certain charts.

One of the brilliant contentions of these fellows was that plain figures are too old-fashioned and inadequate to show results. All manufacturers of material, therefore, were to be prohibited from reporting their weekly production in figures, and were to be compelled instead to draw a line upon a chart. Every week each manufacturer was to send his weekly chart to headquarters where it would pass through the hands of the official-chart corps for preliminary treatment.

These artists, or rather chartists, were to analyze and dissect each chart, gaze at each line upon it from various angles, and, from both near-by and from afar off, measure the spiritual essence of that line with their superior natural and cultivated chart instincts and then interpolate its hidden meaning into a superchart to go to the man higher up.

The man higher up was to permit the hidden meanings to penetrate his inner consciousness, fuse them with the fire of criticism, freeze them with his cold, analytical glance, extract from each line or cabalistic hieroglyph, its particular phase of influence on the winning of the war, and then combine these doubly hidden meanings into a master chart for the enlightenment of generallisimos and other high boys.

And after these master charts had been reverently brought into the presence of the one highest up he, being somewhat reluctant to admit himself unscientific in methods of management, and yet being in total darkness as to what it was all about, would have his secretary write upon these charts tiny, lead-pencil, old-fashioned figures showing what quantities each of the hieroglyphs were supposed to represent.

THAT GINK"

Alas, that this should be not only a joke, but also a fact!

Uncle Sam fell for these one-idea men and let them exploit their theories at the expense of progress until things became so beautifully balled up that it was necessary to call for a new deal with the one-idea management jokers left out of the pack.

This is not intended as a wholesale condemnation of "scientific management." The work of Frederick W. Taylor was invaluable to industry because it made men *think* about management methods—something they hadn't been doing before.

And thinking about these things led to the improvement of management methods in general.

Taylor, being an instigator of thinking, was a common benefactor, whereas the management *faddist*, being a befuddler of thought, is a common enemy.

Time studies, for example, are invaluable when made by those who know what they are doing and why.

The Prussian Guards were wonderful examples of the result of the wrong kind of time and motion study—they could goosestep to perfection, but it didn't get them into Paris.

Men who are forced to follow the meaningless forms of a one-idea man's system of management have the same degree of enthusiasm in doing so as you or I would have if forced to practice the Buddhist ritual.

A man can't laugh in his sleeve at you and roll his sleeves up for you at the same time.

This gink that we're agin is not always a professional systematizer. Too often he is a manufacturer himself, who otherwise perfectly sane is a bit nutty, so to speak, on management theories.

Many a manufacturer who would never dream of exploiting a defective machine will fool himself into maintaining and exploiting a system of management that has four missing cylinders and a slipping clutch.

Whoever he is, he is a common enemy, for he smothers profits under a blanket of unnecessary red tape and at the same time invites the ridicule of his employees who know that he is fooling himself or being fooled.

The one-idea man is a public asset—when his idea is a big one and a sane one. He is a public liability when his idea is a fad.

During the coming months you will consider how you can make your management methods keep step with the coming period of progress.

Avoid fads and fancies.

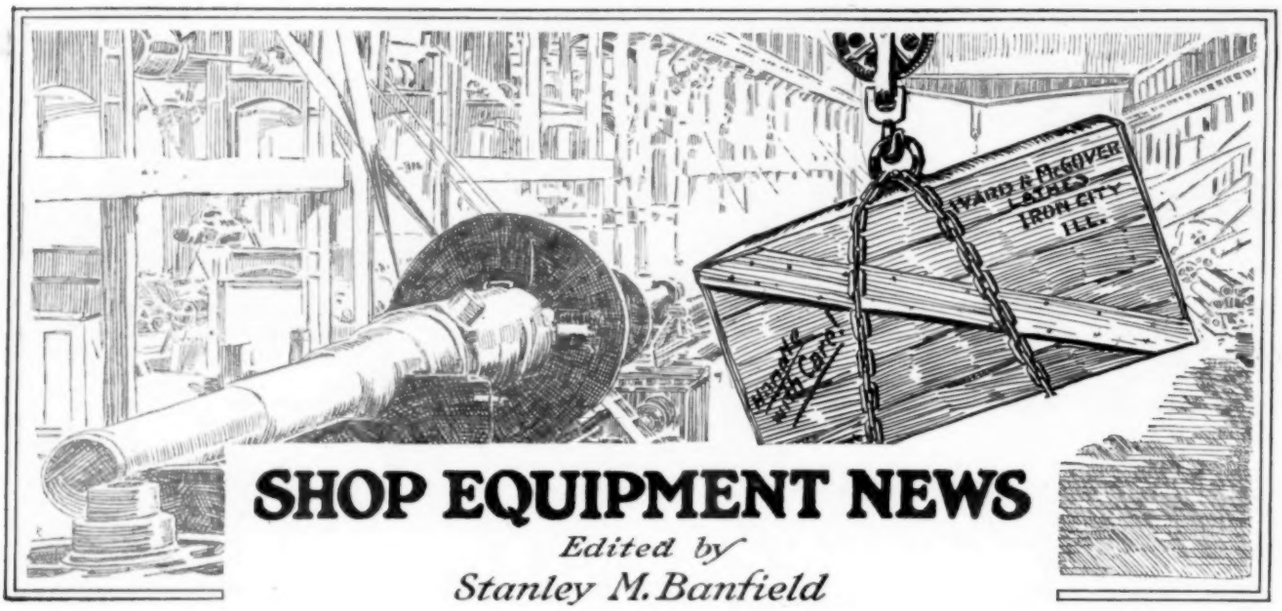
Don't stop with paying a systematizer for telling you the good points about the system he has installed in your shop. Pay the boys in the shop for telling you about its bad points.

Most of you who read this are living examples of what individualism plus American opportunity can accomplish.

Individualism is Americanism, and anything tending to destroy Individualism will destroy Americanism, whether that thing is misapplied management methods or labor communism or government paternalism.

Fads are in the discard today and facts in the ascendancy.

John H Van Deventer



SHOP EQUIPMENT NEWS

Edited by
Stanley M. Banfield

In conformity with a Post Office ruling, descriptions of new equipment can only be used in this department which have not been previously or simultaneously advertised in this or any other periodical.

Ready Welded Tools

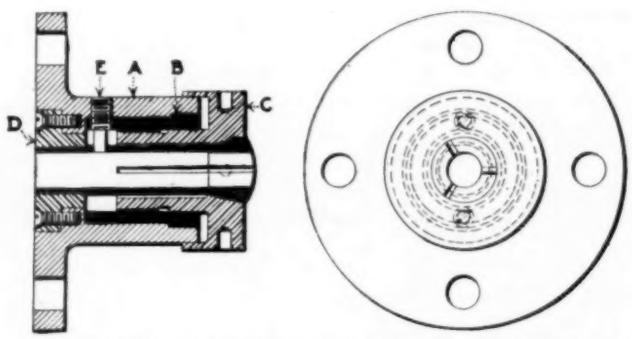
The Ready Tool Co., Bridgeport, Conn., is now welding high-speed steel to low-carbon steel for the purpose of making cutting tools or for other like uses. The illustration shows a counterbore made by this method, the

COUNTERBORE MADE BY THE READY ELECTRIC WELDING PROCESS

difference in color showing where the weld between the two materials occurs. The electric-welding process is used, and it is claimed that considerable saving is made by the use of the shank of lower-priced material and that considerable machining is saved. The company is prepared to do the welding and annealing for concerns that may desire to perform their own finishing operations.

Bemis Lathe Chuck

The collet chuck shown in the illustration is the product of the E. W. Bemis Machine Co., Worcester, Mass., and while primarily intended for a lathe chuck it is useful on other types of metal-turning machinery. A distinctive feature of the chuck is the method employed for operating the collet jaws, which have no longitudinal movement. They are held securely in the chuck body but do not ride upon it. The closing member rides upon the taper of the jaws in opening or closing them, and it is claimed that this construction makes for uniformity in the length of the work, which is of course a great advantage in cutting off stock. The chuck consists of a body *A* reinforced by the sleeve *B* which is threaded to receive the chuck-closing member *C*. This member is knurled for operation by hand, and is also provided with holes for a spanner wrench. The collet jaws, which are interchangeable for varying sizes of work, screw into the steel nut *D* and are held firmly in place by the headless setscrew *E*. In the illustration the chuck shown

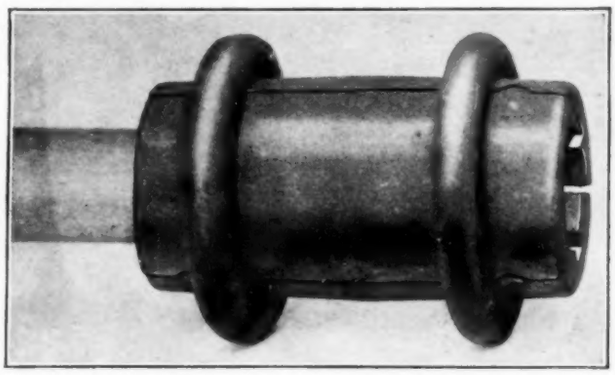


BEMIS COLLET CHUCK WITH FLANGE FOR BOLTING TO FACEPLATE

is flanged for bolting to a faceplate, but it is also made in a style suitable for screwing onto the nose of the spindle. It is furnished in two sizes, the smaller taking collets from $\frac{1}{32}$ to $\frac{1}{2}$ in. and the larger taking collets from $\frac{1}{16}$ to 1 inch.

Clark Compression Coupling

The illustration shows a new form of compression coupling that has recently been placed on the market by C. H. Clark, 60 Grand St., New York City. The entire device consists of three pieces, which are laid against the shaft, and two rings. The outside of the three pieces forming the main body of the coupling are slightly tapered and the two rings are driven on from either end, and compression is thus secured that is sufficient to hold the shafts firmly together. In installing these couplings sufficient space is left between the ends of the two shafts to allow the rings to be slipped be-



CLARK COMPRESSION COUPLING

tween and over them. It is also claimed that this coupling will line up the shafts. Additional compression rings can be used if desired.

Blomquist-Eck Horizontal Boring Mill

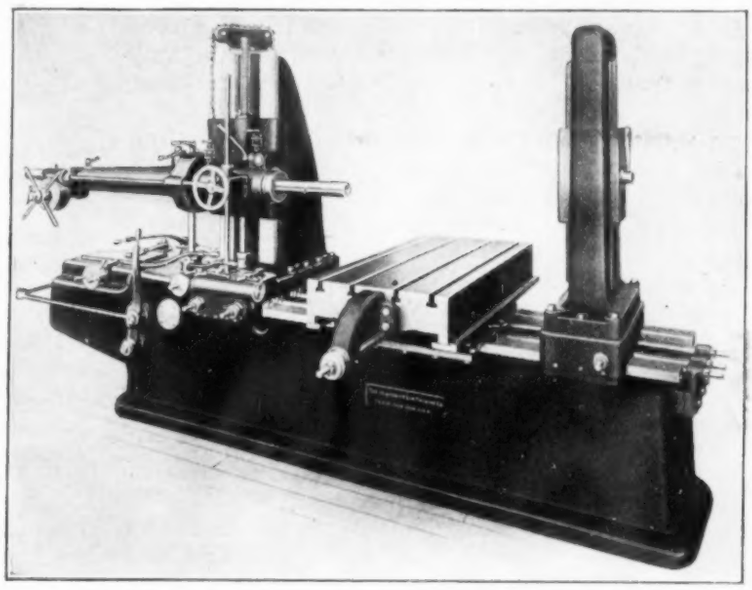
The Blomquist-Eck Machine Co., 1146 East 152d St., Cleveland, Ohio, has recently placed on the market the horizontal boring mill shown in the illustration. The new machine has been designed with a deep bed, or base, of box pattern, which it is claimed eliminates an inherent fault of most machines in that it provides an ample amount of metal directly under the column where the greatest stresses occur. It is also claimed that the speeds and feeds are such as to allow the most advantageous speeds and feeds to be used for any class of work that is likely to be handled. In building the machine a complete system of jigs, fixtures and gages is used, thus insuring interchangeability of parts. The various groups of mechanism form complete individual units, and any unit can be inspected, removed or replaced without disturbing the adjoining unit.

The bed, or base, is of box section cast entirely in one piece, the outer walls directly under the column being left intact without cored openings, a feature of construction that is said to add greatly in resisting the lines of stress. Chip chutes are provided, and these are so arranged that their walls give additional strength. The bed is reinforced directly underneath the column by sections tied together and cast integral with the base, the bed being further reinforced by heavy ribs running lengthwise and at right angles. The column is also of box section and is braced internally by ribs placed in both horizontal and vertical positions. The sides are tapered and flare out at the bottom, giving a large bearing on the bed.

The spindle saddle is designed with a long, narrow guiding edge with a single-screw, adjustable, taper gib for adjustments on one side and a square lock form with gib on the other side. The center of the spindle is placed close to the column face in order to avoid overhang, and the elevating screw is placed between the column faces and the spindle. The units comprising the spindle and saddle are counterbalanced by a weight within the column. High-carbon heat-treated steel is used for the spindle, which is ground its entire length and bored for a Morse taper. End thrust in both directions is carried on ball bearings. The spindle sleeve consists of a hammered, high-carbon steel forging ground inside and outside and provided with tapered adjustable bearings made of Government bronze. Either bearing can be adjusted to compensate for wear, and sight-feed oil cups are provided.

A shaft and a set of planed-steel bevel gears are used to raise the boring-bar support and spindle saddle in unison. The bar support, or bearing proper, may be securely clamped by a lever binding bolt in any position desired. The close-coupled drive-gear shafts are mounted on S.K.F. double-row self-aligning ball bearings. All shafts are made of high-carbon steel, and gears are of hardened steel-ring type, heat treated and shrunk on cast-iron hubs. The smaller spur gears of the drive are made of solid steel heat treated, while all bevel gears are planed from hammered-steel forgings. The speed changes are made by two levers at the front of the machine operating selective sliding gears. The entire driving mechanism is located in the base, and each individual shaft and bearing can be removed and replaced without disturbing any adjoining unit, access to the entire unit being had through the oil-tight top plate cover. All gears run in a bath of oil, and in addition a positive cascade oiling system is provided for both gears and bearings.

Feed to the spindle in either direction, to the spindle saddle in raising or lowering upon the column, to the table saddle parallel to the bed or to the table longitudinally upon its saddle, is introduced through direct positive gears in a manner similar to that used for the speeds. The shafts are of high-carbon steel mounted on



BLOMQUIST-ECK NO. 1 HORIZONTAL BORING MILL

Diameter of spindle, 3¼ in.; travel of spindle, 30 in.; taper in spindle, Morse No. 5; number of speed changes, twelve, 16 to 196 r.p.m.; number of feed changes for spindle or table, 9; number of feed changes for spindle or table with back gears, 18; feeds, 0.003 to 0.518 in. per spindle revolution; working surface of table, 24 x 54 in.; automatic longitudinal feed of table, 36 in.; automatic traverse feed or parallel movement of table with bed, 37 in.; maximum distance from spindle nose to outboard bearing, 5 ft. 5 in.; maximum distance from top of plain working table to center of spindle, 27 in.; maximum distance from top of bed to top of table, 10 in.; diameter of constant-speed friction drive pulley, 14 in.; width of driving belt, 4 in.; speed of friction driving pulley, 350 r.p.m.; weight, crated, 11,600 lb.; horsepower recommended, 5; motor recommended, constant speed, 900 to 1200 r.p.m.

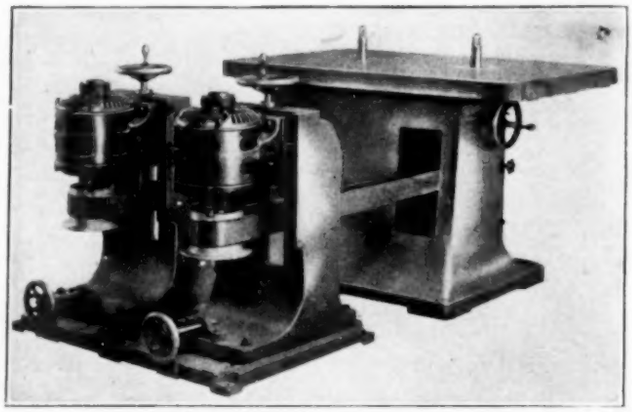
S.K.F. ball bearings. The gears are of steel, heat treated. The entire feed mechanism is located in the base, and any unit may be removed and replaced without disturbing any adjoining unit. All gears run in a bath of oil, and in addition a cascade oiling system is provided for bearings and shafts. The feed changes are made by means of two levers placed directly in front and at the top of the gear box, there being three selective interlocking levers provided in addition, which engage either the spindle, vertical or table feeds. No two conflicting feeds can be engaged at the same time, and for operating star-feed facing heads or work of similar nature all feed levers can be positively locked in a neutral position. Convenience and safety for the operator are provided by placing all controlling levers at the front and high enough so that there is no occasion to stoop or reach beyond the normal working position.

The bed surfaces have been so designed and proportioned that the use of a long, deep saddle to compensate for any overhang of the table at the extreme front and rear positions has been made possible. When in either of the extreme positions the table is supported in the saddle for practically three-quarters of its entire length, the saddle being gibbed to the bed by the square-lock method having a long, narrow guiding edge with a taper gib for adjustment. The table is reinforced by ribs, is provided with T-slots and is gibbed to the saddle by the square-lock method. A friction-type power rapid traverse is provided for all members operated by the feed, and this operates at one rate of speed in either direction. It is instantly engaged or disengaged without disturbing the original feed setting, and the clutch control is so sensitive that it is said that practically any amount of travel can be had. An adjustable safety friction leather washer in the clutch mechanism prevents damaging any portion of the mechanism engaged. Hand feeds are provided for the spindle travel or movement, table saddle and table in addition to the automatic feeds, all screws being fitted with graduated dials.

A single friction clutch pulley drive operating at constant speed is furnished as regular equipment, but constant or adjustable-speed motor drive can be furnished if desired, as can also any type of electrical control, such as manual, automatic or push button. Attachments such as circular swiveling table, auxiliary table and star feed are furnished as extras if desired.

Oliver Motor Drive for Double-Spindle Wood Shaper

The Oliver Machinery Co., Grand Rapids, Mich., has placed on the market a new compact motor drive for double-spindle wood shapers, the new drive making use of standard vertical motors. As shown by the illustration a separate motor is used for each spindle, each motor being mounted on vertically gibbed ways, adjustable by means of a handwheel and screw so that the motor can be located at the correct height, as shown by the scale and as called for by the height of the spindle to suit the work. Each motor stand is independently adjustable to and from the shaper to adjust the tension of the belt. Another advantage is that either shaper spindle can be run independently. It is said that the new arrangement takes up less room on the floor because the distance required between centers is only 5 ft., making the actual floor space about 7 x 5 ft. The arrangement makes use of standard vertical motors, doing away with the need of specialized built-in motors, and can be adapted for new shapers and also for those already in use. The motor-starting unit may be of such a type as is desired.



OLIVER MOTOR DRIVE FOR DOUBLE-SPINDLE WOOD SHAPER

Lindblad "Adlight"

The jointed electric-light fixture shown in the illustration is one of the recent products of K. F. M. Lindblad, 65 Sudbury St., Boston, Mass. It is particularly designed for work in the shop or for other places where it is desirable to move the light around considerably in order to locate it at the most convenient point. The device is made of ⅜-in. square steel tubing, the links swinging alternately sidewise and up and down and the cord being run on the inside. The device is 42 in. long, but can be readily extended if necessary by the use of a piece of ordinary ½-in. iron pipe. It will be noticed that there are no slide points, wire loops or thumbscrews, it simply being necessary to take hold of the light and push it to the position desired.

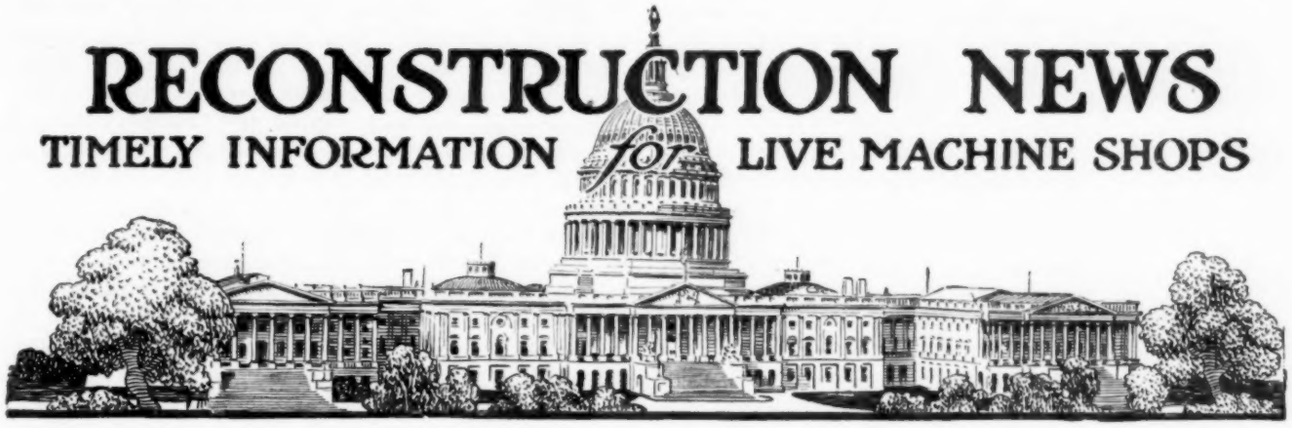
LINDBLAD "ADLIGHT"

Carnegie Electric Tool Steels

The Carnegie Steel Co., Carnegie Building, Pittsburgh, Penn., has recently placed on the market a new line of electric carbon tool steels, these being made in five grades ranging from 70- to 130-point carbon content. These steels are made up in a considerable variety of sizes and shapes as are generally required for machine-shop tool work.

RECONSTRUCTION NEWS

TIMELY INFORMATION for LIVE MACHINE SHOPS



DURING the 19 months, April, 1917, to November, 1918, the United States was a belligerent in the world war, says the chairman of the Federal Trade Commission. American industry and finance passed through an ordeal that brought both strength and weakness into sharp relief. Before this nation could strike its full stride things were reduced to rather elementary and primitive terms. Much of mystery and of pretense was swept away. Out of it all must come to those in varied pursuits and walks of like a charity and understanding, one with the other, based on fuller knowledge.

During these 19 months the Federal Trade Commission had a peculiar opportunity to sense what was going on, especially in the industrial world. It has been the cost-finding agency of the Government; the expert accountant to the War Industries Board and its price-fixing committee; to the Army, the Navy, the Food Administration, the Fuel Administration, the Railroad Administration, the Shipping Board, the Post Office and other agencies.

Lessons of War Cost Finding

It is to be remembered that cost finding and price fixing were two entirely different functions. One was a striving for exact fact through painstaking study and labor; the other, building on this fact foundation, was a matter of discretion, of judgment, of accommodation to seen and unseen forces and an effort to distribute equitably the hardships inevitably resulting from the dislocations of war.

In its cost-finding work the Federal Trade Commission of necessity had to search into the very vitals of industry. Some took this as a matter of course, appreciating at once the end in view. For some other industries, however, such intrusion into the privacy of business was met at first with reluctance and misgivings. For the latter this attitude quickly changed, however, and these industries also welcomed and aided the commission in its work. At the end it can be said that there remains no suspicion that a single business secret has been betrayed. Costs were obtained from whole industries, sometimes involving in a single inquiry the examination of the books of thousands of companies. These results were brought together and presented without disclosing the identity of individual figures except to the responsible officers of the Government and after opportunity for scrutiny by each concern of the processes and results as to its own case.

Thus came confidence and understanding where impersonal discharge of duty was met with candor. The vast majority of patriotic and enlightened men of affairs welcomed every effort to steady and stabilize industry as it gathered its vast powers to ride the red seas of war and to deliver the tremendous blow against the enemy.

Before this country entered the war, and therefore before war powers could be exercised in control, a huge and false price structure was built up, and in spite of all that could be done it became more aggravated. Cost of living and wages went upward as prices rocketed. That price structure and its attendant inflations to-day are among the chief perils of the reconstruction period. That they are no greater can be attributed almost wholly to the coöperation of industry in the program of price fixing which checked, so far as possible, mounting prices and for the time negatived price based solely on supply and demand.

One great handicap lay in the fact that basic natural resources had been appreciated in value before the price-fixing function came into operation. European belligerents had for three years been bidding frantically for the treasures that nature had placed under our stewardship, and as a result our raw materials had been hugely written up before the United States entered the war. So when price fixing was undertaken it started from inflated value for undug ores and coal; untouched petroleum and uncut forests. Despite this false start and the difficulties that flowed therefrom, cumulating in all subsequent industrial operations, price fixing did stabilize industry and insured it against ruinous collapse at the end of the war.

Costs for 10,000 Industries

It is estimated that in its work for various Government agencies the Federal Trade Commission obtained cost and production figures of upward of 10,000 companies in scores of important industries and many minor ones which had an approximate aggregate investment of $20,000,000,000 and the commodities directly affected by such cost findings represented annual sale values of at least $30,000,000,000, not far from twice the amount of the First Second and Fourth Liberty loans taken together.

These cost studies by the commission demonstrated frequent and great deficiencies in the accounting methods employed by mining and manufacturing concerns, especially in cost-accounting methods. In some

of the oldest and greatest industries there was not even an attempt at that determination of unit costs and profits by products which is essential generally to the safe conduct of industry.

It is evident that where such cost accounting is not established it should be introduced and where it is defective it should be reformed. Inventories should be carefully kept; labor and material used should be accounted for as used; indirect and overhead charges should be fairly allocated and proper allowance made for depletion and depreciation of resources and plants. On the other hand capital charges for construction should not be mingled with operating or production expense nor should there be introduced items of actual or imputed outgo, such as income and profit taxes, depletion of appreciation of plant investments or interest on capital owned.

Business World Wants Correct Costs

However where complete records are kept it is relatively easy to correct bad principles, reject improper items or introduce omitted ones. Inventories and records of expense and sales by products are necessary to compute profit and loss by products.

The business world, well aware of the extent to which defective cost-accounting methods prevail, is alert to promote reforms. A few years ago the Federal Trade Commission initiated an effort to be helpful in this direction and applied to the Congress for funds to carry it on. As these were not given the movement lagged, but as a result of the commission's enforced studies and as a byproduct of its war work that effort may well be profitably and economically resumed. If the earlier effort of the commission could have gone forward before the war the Government would have been repaid many times over during the war through making it possible to ascertain costs much more expeditiously and cheaply.

In the immediate future the question of costs will be especially critical for the nation's business in arriving safely at post-war readjustments. The matter is important to the individual producer, to his banker and to the industry and the public at large.

The cost and profit findings of the commission developed many facts of interest, but was done under such pressure that there has been little time as yet to analyze or interpret the results. Two facts, however, which are generally known, may be mentioned. First, the average cost during the war period was much higher than before the war; such increases were frequently as much as 100 per cent. Second, the variation in costs between different companies, often considerable in normal time, was enormously exaggerated under war conditions.

The great increase in average cost was due in part to increase in cost of the instruments of production and material and supplies; to increased cost of labor partly through increase in wages, but more through violent and frequent shifting of labor and a consequent loss of the efficiency that springs from organization, habit of work and special skill; to wastes caused by effort for increased production and, of course, to the general depreciation of money in terms of goods or services. The cost of living continued to mount rapidly, and with it wages and labor cost.

Fundamental to the cost increases, however, was the writing up of values of natural resources. This tended to bring about the production of raw materials from relatively barren or inaccessible sources with a consequent diversion of labor, capital and transportation to uneconomic operations. It is doubtful whether high prices did really stimulate production to the degree that has generally been believed.

Where there were successive stages of production in an industry (sometimes integrated and sometimes independently operated) the costs were increased by the taking of high profits between the successive stages of production. High costs or high profits, or both, in one stage had a cumulative effect on costs in all succeeding stages—a sort of pyramiding of cost. Price fixing arriving too late to get at the source of the trouble in the short space of the war, was useful in checking its unlimited extension.

The abnormal variation in costs came largely from the bringing in of uneconomic supplies of raw materials and the writing up in value of advantages by integrated concerns and those controlling natural resources. Congested transportation and dislocations of labor with the consequent irregularity of industrial operations also made for wide cost variations.

In considering such variations, however, it should be borne in mind that the lower-cost company may not be more profitable than the higher-cost producer even when both sell at the same price. Often the lower cost is the result not of greater economies or natural advantages but of investment in more stages of production or in more extensive mechanical equipment, and the larger unit profit resulting from the lower cost is absorbed in providing the proper return on the greater unit investment.

Discussing Actual Costs

Not the least benefit of cost finding incident to price fixing was the bringing together, with Government officers, of the representatives of the industries for full and frank discussion of costs, methods and products. This, with the assembling of such a body of current data as was never before had in this country, demonstrated the value of such meetings and of the preparation and exchange of such proper and useful information.

It would seem that the commission might well continue, at least as to certain industries, this assembling and distribution currently of basic and reliable information, and that, well within the law, industry, meeting with Government officers, might continue to exchange helpful experiences and information without the danger of being suspected of price fixing or other restraints of trade.

If certain laws enacted to deal severely with admitted abuses are fully observed in their spirit in this manner it would seem that the public interest would be fully served. In such case a peace-time adaptation of the war-time meetings between individuals and Government for frank discussion, would be as helpful as it would be innocent of wrong intent or harmful effect. Such open conferences might be expected to serve all the good and necessary ends which are among those sometimes sought by clandestine meetings. Pursued in the generous American business spirit of fair play such confer-

ences might be extremely useful by ascertaining the facts and clearing away doubts and suspicions.

From the experience of cost finding we believe we may argue for: (1) Standardized accounting systems suited to the various industries; (2) cost and profit accounting for individual products; (3) reasonable standardization of products and elimination of excessive costs due to unnecessary multiplication of styles and types; (4) compilation and issue of current basic trade information; (5) conferences between industries and Government for the exchange of proper and useful views and information.

As for the outlook there need be foresight but no fear. A period of readjustment must be met with the new and broader view. The same coöperation of industry, of labor, of capital and of Government that armed the nation for war will make it still greater in peace.

Readjustment Period

As a nation we organized lines of supply and communication from Chile and Australia and Alaska and from every state and every farm and factory, and through these lines across oceans and continents to the battle front of France. As a nation we arrived at a power to dispatch a ship loaded with men and food and supplies on the average of every 10 minutes night and day, Sundays and holidays. As a nation we launched ships at the rate of 490,000 gross tons a month, or about 700 tons every hour, on the average. As a nation we armed and sent across the sea our young men, true crusaders of democracy, at the rate of 10,000 a day. As a nation we threw upon liberty's altar billions and billions of dollars in loans—about $500 at every tick of the clock, day and night, Sundays and holidays.

Such a nation, as a nation, may turn with confidence to the solution of whatever problems of industry or finance which the future may hold in store.

Locomotive Repair Work

One of the bright spots in the railroad administration is the Mechanical Department Circular No. 6. This has a direct bearing on the repair of locomotives which gets it directly back to the machine shop and the machine tool. We shall never know how many hundreds of thousands of dollars it has cost us to save a few thousand dollars' worth of oil on our locomotives during the past 20 years when the oil-saving craze has been upon us.

This points out that:

Investigation has developed that in many instances locomotives are not properly lubricated, which in addition to increasing coal consumption also causes excessive wear on cylinders, cylinder packing, valves and valve chambers as well as on piston-rod and valve-stem packing.

It has been found that this is due on some roads to the practice of draining lubricators of all oil upon their arrival at the terminal and putting in the exact amount allowed for the trip before leaving. If excessive switching is necessary during the trip, or if any other unusual delays occur, or if the oil feed is not so regulated that it will last during the trip the locomotive is often operated to the terminal with cylinders not lubricated. Cases are also found where on account of this practice yard engines are worked for hours without cylinder oil. This practice is extremely expensive.

Lubricators should be filled before locomotive leaves terminal and sufficient oil should be carried on the locomotive to provide against any necessity for damaging cylinders, valves, packing or other parts of the machinery during the trip. Piston-rod and valve-stem packing should be properly lubricated and a suitable swab provided to retain the oil. Enginemen will be held responsible for the proper use of all lubricating oils furnished them.

It appears to be the consensus of opinion that one outlet for the surplus capacity of the United States is in the direction of foreign trade, and with that in mind T. C. Powell, special representative of the United States Railroad Administration with the War Industries Board, is addressing a large number of the firms which in the course of the past year have had relations with the War Industries Board, to establish a point of contact between the United States Railroad Administration and the exporters and importers of the country, to ascertain whether the administration can be of any substantial assistance.

The Port and Harbor Facilities Commission created by resolution of the United States Shipping Board in May, 1918, has been for months collecting all the information available with regard to facilities at the ports, and is coöperating with the Railroad Administration in preparing other data for consideration.

Any information regarding the foreign trade of the machine industry will be of service in this connection. Coöperation is necessary for success in this work.

Hobbing Wormwheels Without Gashing the Blanks

By Oscar Craft

I recently had occasion to set up the milling machine to hob a number of wormwheels without gashing the blanks in the usual manner.

The hob is placed on the arbor as near to the column of the machine as could be done without making the work interfere, and farther out on the arbor is mounted one of the regular change gears of the milling machine. This meshes through a suitable intermediate train with a gear upon the wormshaft of the dividing head.

The number of gears (odd or even) in the intermediate train depends upon whether the wormwheel to be cut is right or left hand, while the ratio of the driving to the driven gear is a result of the circular pitch of the wormwheel and the reduction gearing in the dividing head. This latter is usually 40 to 1, and as the wheels under discussion had 48 teeth, the gears I used were 40 to 48.

The intermediate gears must be mounted on a swinging link to compensate for the slight up-and-down movement of the knee when setting the hob into the work, and this can easily be done by fitting a piece of 1 in. x ½-in. cold-rolled steel to turn freely upon the outer end of the dividing-head shaft, drilling the bar at the proper places for studs on which the intermediate gears are mounted, and connecting the outer end of this bar to the milling-machine arbor by a link of suitable length which has a hole in one end to fit a collar on the arbor while the other end swings about a pin in the end of the bar.

Theoretically of course there is a slight relative rotation of the work, which is mounted upon a mandrel between the centers, when the knee is raised to the cut, but this movement is so slight that it may be disregarded.

Announcing a New Member of the McGraw-Hill Family

On March 1 of this year a new member of the McGraw-Hill family of engineering publications will make its initial appearance. It will be a monthly technical magazine issued in Spanish under the name *La Ingenieria Internacional*, and will serve the particular engineering requirements of Latin America and Spain.

This new periodical is the outcome of a natural evolution and has been under consideration for some years. Its purpose is to afford a medium for the presentation of those developments in American engineering which will be of value to Spanish-speaking enginers, contractors and manufacturers whose occupations call for a more diversified application of engineering than can be covered in a technical journal having a strictly specialized industrial field. At the same time the best engineering practice in Latin America, Spain and other Spanish-speaking countries will be reflected in the columns of *La Ingenieria Internacional*, so that, as the name implies, the reader of this magazine will have at hand a symposium of engineering methods representing the latest and best of all countries.

This new engineering journal will be an important medium in the development of international good-will and at the same time a medium by which American manufacturers engaging in export trades can carry their message to prospective buyers in foreign lands, reaching a class of people that has not been reached even by the extensive foreign circulation of the existing McGraw-Hill papers, which are confined to the English language.

La Ingenieria Internacional will be more than a general engineering publication. It will be a highly specialized journal of general engineering, particularly designed to serve those portions of the world which are newly developing and where the engineer, the contractor and the manufacturer must turn his hand to many lines. The field of this paper is entirely distinct from that of the *American Machinist* or any of the McGraw-Hill journals, which will continue to be the leading exponents in the English language of the latest and best in American engineering practice.

Draftsman or Engineer?

By E. A. Dixie

I thoroughly indorse M. E. Duggan's sentiments expressed on page 1088, Vol. 49. I have not done much designing during the past 15 years or so, but recently I had occasion to design a small machine. The first thing I did was to get the mechanism down on paper. This done I took my drawings to a patternmaker only to find that he was working on Government work and could not handle the job. The rest of the patternmakers in town were just as busy, so I decided to make the patterns myself.

Up to this time I had merely satisfied myself that the machine would function properly. For the time being I was merely a draftsman—the parts would work properly and would not interfere. But as soon as I assumed the rôle of patternmaker I saw that slight changes in the drawing would greatly reduce the cost of the patterns and expedite their completion. By the time I was partly finished with the alterations to the drawings it suddenly struck me thuswise: "Making patterns that can be molded is not the patternmaker's job. The efficient patternmaker should make the patterns so that they will not only mold but mold easily."

There is a core at that part of the pattern. The core is there because there is an undercut that will not draw. Can the undercut be dispensed with without impairing the functioning of the machine? If it can be dispensed with we can also eliminate core prints and core boxes, the casting can be made in green sand and no cores will be necessary. When I got thus far it struck me again: "There's a whole lot to this designing job," so before going further with the work I made my patterns in my mind, molded them in my mind and in my mind carried them to a mental machine shop so that I could mentally discover what troubles I would run into when I had all the castings made.

I found in this case that they would be easier to machine than they would have been if made as originally intended. This is usually the case, and should be so; the job that has enough clearance to pull out of a mold should be easier to machine.

Very few of us are clever enough to be experts at more than one branch of the machine business, but before a man is entitled to dub himself a designer he should have a good working knowledge of patternmaking, molding and machine work, so that he can determine the least expensive way, and whether simplicity of pattern or foundry work will compensate for complexity of machine work or vice versa.

Help in Solving Industrial Problems

That the pressing problems of industrial management have shifted from methods to men is seen on every hand. This has developed a new angle to management, and realizing the need for experienced council in this line the Industrial Relations Service, Ltd., has been formed with offices at 50 East 42nd St., New York, to act as adviser in all kinds of industrial differences or, better yet, to advise before the differences arise at all.

The organization is comprised of a group of men who have had diversified experience in this field, and include George E. Holmes as president, Joseph A. Holland vice president, William J. McDermott and Charles R. Chase. Of these perhaps Mr. Holland is best known to the machine industry, having been connected with the National Metal Trades Association, the General Electric Co., the Remington Arms Co. and the American Sugar Refining Co. in charge of employment in its various branches.

Such an organization can be of great value in preventing labor turnover and discontent by pointing out to managers who have not studied the human element or the changing conditions of employment.

LATEST DEVELOPMENTS IN THE AUTOMOTIVE INDUSTRIES

Aircraft · Motor Trucks · Tractors

At present there are 350 concerns, employing about 200,000 men and women, engaged in supplying accessories for aircraft in the United States.

The minimum number of acres on which two, three or four plow tractor outfits may be expected to prove profitable, according to tractor owners, is 130, 170 and 210.

There are in the United States about 130 manufacturers making about 200 varieties of tractors. The engines used in these tractors vary from one and two cylinders, with bores of about 10 in., up to eight cylinders of 3¼-in. bore by 5-in. stroke.

Australian commercial and financial interests are formulating plans to connect Australia with London and other sections of the British Empire by commercial airplanes. A company has been formed to finance the survey of an aerial route to London by way of Sydney and Port Said.

The tendency among German airplane designers to return to the monoplane for certain uses is apparent. As near as can be ascertained there are two types of monoplanes in existence in Germany, namely, the Junker, having a stationary engine, and the Fokker, with a rotary engine. Monoplane-seaplanes, the fuselage of which is above the wings, have been used by the German navy. These seaplanes attain a speed of 100 knots.

Military planes flying above an altitude of 10,000 ft. are equipped with an apparatus for supplying oxygen to the flyers. It was proved by the English air casualties that 90 per cent. of the accidents was due to the flyers suffering from lack of oxygen. The device was designed by Lieutenant Colonel Dryer of the British R. A. M. C., and works under variable tank pressure from 100 to 2250 lb. per square inch with a temperature range of from 70 deg. to 80 deg. F. to 20 deg. or 50 deg. below zero. The first of these devices was made by De Lestany, Paris, and an original model was brought to this country to start quantity production. Under the direction of Brig.-Gen. T. C. Lystor of the Medical Research Board and the Bureau of Aircraft Production over 5000 have been manufactured and accepted by the Government up to date, and over 3600 have been shipped overseas.

Comparison by the United States Aircraft Board between the manufacturing prices of the Liberty motor and some of the best European motors demonstrated that the European engines would approximate $10,000 an engine, while the Liberty engine of greater horsepower, which was produced originally for $6000, is now $5000.

Appropriations for keeping the roads clear of snow in New Jersey will be made by the various boards of freeholders. Motor trucks with snow plows attached will be used. In rural communities a 3-in. layer of snow will be allowed to remain to facilitate the running of sleighs; in thickly-settled communities the roads will be cleaned entirely.

The United States Navy Department purposes a system of aerial defense of the American coast line by erecting 90 hydroplane stations between the Atlantic and Pacific coasts and will include Panama, Hawaii, Guam, Alaska and the Philippines. Hydroplanes with a speed of 160 miles an hour and dirigibles of the Zeppelin type will be used for patrolling. The cost is estimated at $85,769,300 for the next fiscal year.

The latest Benz airplane motor has aluminum pistons and an adjustment on the carburetor for flying at high altitudes. The motor has an offset crankshaft that has for a long time been common in German and Belgian construction. Offsetting the crank has the effect of decreasing the guide pressure of the piston and cylinder and lengthening the stroke of the piston, as the offset is increased with any given crankpin circle.

To illustrate that highway transportation is vital to the nation's business S. W. Feim of the Automobile Chamber of Commerce gave some interesting examples before the Society of Automobile Engineers. In Iowa the International Harvester Co. laid out several motor-truck routes around Mason City, ranging from 90 to 150 miles in length, to demonstrate that a rural motor express is a paying proposition. Afterward a company was organized with a capital of $50,000 by leading business men of Mason City and the lines taken over. Between Indianola, Iowa, and Des Moines freight is being carried by motor truck for $17.35. The same load by railroad costs $23.41. The load was handled five times by railroad and only twice by truck.

The Pierce-Arrow Motor Car Co. is making a six-cylinder 24-valve engine, using it on the new passenger cars known as the Series 5. The advantages put forward are greater volumetric efficiency, smaller valves for the same area, increased time of maximum opening, cleaner scavenging due to the elimination of pockets and reduction of carbon deposit. Each cylinder has two exhaust and two intake valves 1½ in. in diameter placed in the throat, having a ⅜-in. lift and giving the same areas as a 3-in. diameter valve with the same lift. With this arrangement of the valves on a T-head cylinder it was necessary to adopt detachable heads. This is believed to indicate the tendency in motor design for the immediate future.

The British De Haviland single-seater scout is a biplane with a single pair of struts. Both planes have a span of 25 ft. 8½ in. and a chord of 54 in. A dihedral angle of 172 deg. is formed by the wings, which have no sweep back. The lower planes have a uniform angle of incidence of 2½ deg., while the upper plane has 2 deg. near the center section and 2½ deg. at the tips. The machine is driven by a 110-hp. La Rhone rotary motor manufactured by the Darracq Motor Co., London. Its performance, according to the British official rating, is as follows: Endurance at 10,000 ft., including climb, 3 hours; ceiling, 16,000 ft.; speed at ground level, 109 miles an hour, and at 10,000 ft., 102 miles an hour; climb to 10,000 ft., 12 min. 4 seconds.

At the present stage of peace conditions airplane manufacturers are divided into two sets—those who are turning at once from war work to peace work with the immediate prospect of expanding their business, and those who will not put their peace-time projects into immediate effect because they expect, for a few months at least, business will be slow on account of the termination of Government contracts, the high rate and uncertainty of wages and the high prices of material. With the cancelling of Government contracts, especially in those plants that in normal times were not interested in airplane building, a large amount of capital became tied up in raw material unsuited for the general market. Many of these concerns expect that the financial adjustment with the Government will be long delayed, in the meantime tying up their capital so that they cannot resume manufacturing operations to any extent.

SPARKS FROM THE WOR

E. C. PORTER,

The Utilization of Surplus Army Supplies

Division of Military Aeronautics Does Valuable Work in Reclaiming Duplicate Material

The Division of Military Aeronautics has turned up since Aug. 6 surplus supplies worth $10,000,000, and its examiners have not yet finished their task. The supplies listed include typewriters, motor cars, motor trucks, oil, lumber, wood, iron and steel working machines, motorcycles, building material, airplanes and about everything in the accessory line from screw-eyes to stove bolts.

The official name of the body engaged in this pursuit is the Surplus Inactive Supplies Service, Purchase and Storage Branch, Purchase, Storage and Traffic Division of the General Staff, and it has branches in nearly all bureaus of the War Department. Its object is to utilize duplicate supplies purchased through the unavoidable lack of organization in the emergency at the beginning of the war. These surplus supplies are listed, and through a system of trade, transfer and sale they are either used in the department or sold.

Since Aug. 15, the Division of Military Aeronautics has sent out lists of 1200 different surplus items, including more than 50,000 separate units valued at over $3,000,000. Each of the 75 branches in the division was asked what articles it wanted, and so far 532 orders for over 30,000 separate units, at a value of $750,000, have been received. The work of transferring this material to the various subdivisions is now under way, and will continue until the supply of all branches is reduced sufficient for three months in advance.

Already the division has turned over to the Surplus Inactive Supplies Service of the General Staff property amounting to $2,087,341 which none of its own branches could use. Some of the larger items on this list were 150,000 gal. of oil, worth $75,000; 417 typewriters, valued at $25,000, and 200 tons of hay, valued at $3000.

Another class of surplus supplies now being inventoried includes parts for 3500 French Gnome airplane motors listed at the time they were ordered in this country by the French High Commission at $10,500,000 but which now must be sold as junk for from $25 to $120,000 a ton. There are 2000 tons of these motor parts. This motor was at one time one of the most popular in France, but owing to the advance in design it has become obsolete. Very few of these motor parts are finished. Some are yet in steel billets; some are finished as high as 90 per cent. and some as low as 5 per cent.; some have been boxed and sent across seas. All will now have to be scrapped. Eventually they will be paid for by the French government, the money being advanced by the United States.

With these Gnome motors will go 300 Penguin training planes, now obsolete, worth $750,000, and 128 L. W. F. airplanes worth $1,427,000. In this collection will also be 1500 J. N. 1 airplanes valued at $9,000,000, also now obsolete, and 500 additional motors valued at $750,000.

Other material found and immediately put to use was 4,500,000 ft. of ⅝-in. rope. The present demand for this article is very large, and specifications were changed in order to take advantage of this "find." This ⅝-in. rope was substituted for ½-in. rope and the 4,500,000 ft. put into equipment for squadrons overseas, effecting a saving of $75,000.

Another consignment of goods put to use consisted of 500 pairs of field glasses, worth $37,500, found in a supply depot at Omaha. Other supplies amounting to $75,000 were discovered and shipped overseas.

At the Middletown, Penn., depot 9000 gal. of "dope," a preparation for airplane-wing fabric and worth $47,500, was located and used.

Seven carloads of iron, steel and woodworking machinery were found in a supply depot at Hampton, Va. In one of these cars was a wire-testing machine badly wanted in France. Five thousand steel drums wanted for oil containers were discovered in private storage, and while they were not the property of the Government nevertheless they were put into immediate use and the owner was afterward paid.

War Machinery Diverted into Peace Industry

The Waterloo Gasoline Engine Co., Waterloo, Iowa, had just completed the installation of $150,000 worth of special machinery for war work when its contract with the Government terminated. J. E. Johnson, the general manager, says that notwithstanding the setback the plant will be operating at its full capacity by Jan. 1 on gasoline engines and tractors. The company employs more than 1200 workmen.

* * *

Work for Handicapped Men

A recent canvass made of the Ford Motor Co. plant at Detroit gives the following information as to the work that handicapped men can do:

Jobs that could be filled by legless men, 670; by one-legged men, 2637; by one-armed men, 715; by totally blind men, 10. The time required for cripples to become expert at these jobs is estimated for 1743, one day or less; for 1461, one day to one week; for 251, one to two weeks; for 534, one month to one year; for 43, one to six years.

About 18 per cent. of all the employees at the Ford plant are said to be cripples or physically substandard. Eighty-five per cent. of them, however, are classed as fully efficient workers.

* * *

Cost of the World's War

Figures of the war's cost to the world compiled by the Federal Reserve Board show that the approximate public debt per capita had increased from $60 before the war to almost $400 at the end of July. To this is to be added the cost since July.

LD'S INDUSTRIAL FORGE
NEWS EDITOR

Crowell to Direct the Distribution of Surplus Army Property

Benedict Crowell, Assistant Secretary of War and Director of Munitions, has been requested by the President to assume responsibility for the proper disposition of all property acquired by the War Department since Apr. 6, 1917. Mr. Crowell has appointed C. W. Hare, Assistant Director of Munitions, to have general supervision of this work, and Brig.-Gen. C. C. Jamieson has been appointed Director of Sales in direct charge of an organization to be perfected for the disposal of surplus army property.

Policy and procedure upon which sales will be made is being formulated by the Director of Munitions, the Assistant Director of Munitions and the Director of Sales. It is the intention of the Director of Munitions to so market Government property as to interfere as little as possible with business conditions, and to this end the Assistant Director of Munitions and the Director of Sales will, as occasion may require, confer with committees representing the industries affected.

Any information in connection with the various problems involved will be furnished by either the Assistant Director of Munitions or the Director of Sales at their offices in the Munitions Building, 19th and B Sts., Washington.

Personals

W. P. SPARKS is now with the Cleveland Milling Machine Co., Cleveland, Ohio, as its representative at Indianapolis, Ind., with office at 316 Terminal Building.

SAMUEL MOORE, who was formerly general manager of the Bond plant of the American Radiator Co., has recently been made general superintendent of this company.

PHILIP M. HATHAWAY is now chief engineer of the National Lead Co., Crooke Works, Brooklyn, N. Y. He was formerly with the International Register Co., Chicago, Ill.

GEORGE H. JOHN, JR., at one time planning engineer of the Stokes & Smith Co., Philadelphia, Penn., is now instructor in mechanical engineering at Columbia University, New York.

JOHN G. SHIRLEY, assistant works manager of the Gilbert & Barker Manufacturing Co., Springfield, Mass., has been appointed production manager of the S.K.F. Ball Bearing Co., Hartford, Conn.

STEPHEN H. PAINTER is now special representative of the Ingersoll-Rand Co., in Chile and Bolivia. He was formerly with the company in New York as manager of the Calyx drill department.

H. W. CLARKE, recently connected with the McGraw-Hill Co. at Chicago, has been made advertising manager for the Chicago Pneumatic Tool Co., Chicago, Ill. Prior to his connection with the McGraw-Hill Co. he spent eight years with the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.

H. C. WHITE has been appointed factory manager of the Harris Manufacturing Co., Stockton, Calif., manufacturer of gasoline, combined grain, rice and bean harvesters. He will enter on his new duties on Jan. 1. During the last three years Mr. White has been engaged in reorganizing the plants of the Holt Manufacturing Co. at Stockton, Calif., and at Peoria, Ill.

Will You Provide the Job?

¶ "Have you a job for a man who is trained for it?" is the question the Federal Board for Vocational Education is now asking the employers of the United States. "The Government will do the training. Will you provide the job?"

¶ It is the intention of the Government to assist in placing each disabled soldier and sailor, regardless of his handicap, in suitable civil employment. The men are not to be dealt with from the viewpoint of giving them special "soft jobs." On the contrary, the employers of America are requested to consider their employment as a business proposition. An effort will be made to place each man in the occupation in which he is most interested, provided it is neither waning nor overcrowded.

¶ How this is to be accomplished is discussed in a monograph, "What the Employers of America Can Do for the Disabled Soldier and Sailor," copies of which may be obtained from the Federal Bureau for Vocational Education, Washington.

Business Items

The Peninsular Machinery Co., Detroit, Mich., formerly located in the Kerr Building, has moved to larger quarters at 279-281 East Jefferson Street.

The Trucson Steel Co., Youngstown, Ohio, has expanded its field of activity and is going into the manufacture of all kinds of pressed-steel parts and equipment. It is in a position to give valuable suggestions for work of this kind and will welcome an opportunity to investigate a possibility for all such equipment and parts.

American Machine Tools in the Export Field

Our Goods Are Now Favorably Known Abroad, and for Years to Come Foreign Demand Will Be Immense

"It has been conclusively demonstrated that machine tools form a considerable portion of the backbone of war," say A. R. McEwan, manager of the machinery department of Gaston, Williams & Wigmore, Inc. "American machine tools have proved their unquestionable superiority, and American manufacturers were early called on to supply the sudden and increasing demand caused by the war.

"Already taxed to the utmost new and enlarged demands were made upon them when this country became a participant in the war. The governmental requirements had to be satisfied first. This naturally brought about curtailment of foreign shipment through licensing exports.

"What should be of the most vital interest to our machine-tool manufacturers right now is the future of American export trade. Our excellent sales and distributing efforts since the war began and the advantages thus gained should be safeguarded by continued aggressive and intelligent tactics.

"The end of the war will leave vast stretches of Europe broken and devastated. Present indications are that France will regain Alsace and Lorraine. After peace is concluded she will then be the richest country in iron in all of Europe. Her great coal fields are not far distant from her iron deposits either. Rehabilitation will be undertaken at once beyond doubt. Belgium also will have to be rebuilt and reëquipped. This will mean great demands for our machine tools. Other territories will also require our products in similar increased volume.

"What condition will the American machine manufacturers face when this era of reconstruction and rehabilitation has begun? This is the period that should be anticipated by America and a keen survey made of the foundations for future trade that were laid in that period of our war-time prosperity. It has required scant salesmanship to market machinery and machine tools during this time. They have been eagerly sought by the foreign buyer at a time when merit of workmanship and design were of least importance and when most anything was apparently good enough to send abroad if prompt delivery could be made. This was fortunately the viewpoint of only a limited number of manufacturers.

"Numerous American machines have

been sold that in other times could never have found a foreign buyer. This is one unfortunate circumstance that may prove a boomerang to some lines of American-made machines and machine tools. True this is an unpleasant feature, but facts might as well be faced courageously if errors are to be righted and permanent progress made.

"There are many other lines of machines that have not suffered through the questionable practices of short-sighted manufacturers, and these lines will certainly reap a golden harvest through preference when normal conditions prevail again. Through all the stress of rush production it has been they who have maintained that high quality for which American machinery has been famous for many years.

"There are many lines of American machine tools that have met with world-wide success because of their greater range of usefulness and adaptability than those of European design. Interchangeability of parts has also been a decided factor in our success. This feature has been met abroad, so is no longer our exclusive advantage. In future we will have to depend on our equipment for quantity production, our wealth of material and our positive quality to overcome the competition whose natural keenness has been made sharper by war-time stress.

"Many of our manufacturers have added vastly to their production equipment in order to meet war demands. What is to happen to this when the war absorption ceases? Are our American manufacturers going to reduce their output and allow capital invested in costly plants to remain unproductive? If so it will only add heavily to the cost of the diminished product, and this would eventually prove industrial suicide.

"The evidence at hand points to the belief that they will seek to maintain the maximum output through extending their marketing facilities. This will reduce unit-production cost and enable them to enter the foreign markets better equipped to meet and defeat competition.

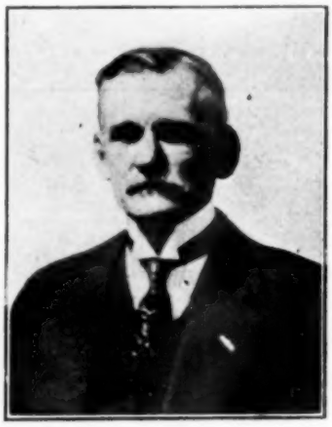
"There are other handicaps to our foreign trade. We have to consider the cost of ocean freights. These will diminish with resumption of unhampered sea traffic, but it will require a long time to resume prewar conditions. Distance from some of our markets and added cost of delivery and delay will also prove burdens to us.

"Briefly the whole American machinery and machine-tool situation can be summed up as follows: Our goods on the whole are now favorably known abroad. For years to come the foreign demand is going to be immense. We can hold the trade won during the war and win more in constantly increasing volume if we do those things which are so plain any and everyone should see. Whether or not this is done depends absolutely upon the foresight, courage and ambition of the majority of American manufacturers."

Obituary

A. R. GORSLINE, for the last 12 years president of the Cochrane-Bly Co., Rochester, N. Y., died at his home Nov. 25, 1918, after a brief illness.

Mr. Gorsline was born at Parma, N. Y., Jan. 27, 1858, and went to Rochester with his parents when he was 13 years old. After completing his education in the public school and high school of that city he went to Auburn State Prison to look after a contract his father had with the state.



A. R. GORSLINE

He remained there about three years and then spent two years in New York in the stationery business, afterward returning to Rochester to enter the Bank of Monroe, where he remained until this institution was merged into the Commercial Bank. About that time his father was owner of a flour mill in Rochester, and due to failing health Mr. Gorsline took over the management of the mill, which he ran successfully for a number of years. On the death of his father Mr. Gorsline disposed of the mill and entered the Cochrane-Bly Co.

When the European War broke out Mr. Gorsline saw the situation in its true light and expressed the opinion more than once that it was the duty of American manufacturers to furnish England and France with the material they so urgently needed, and on the entrance of the United States into the war his attitude was that we were civilian soldiers and that we should coöperate with the Government to the best of our ability. His own extreme efforts during the past four years undoubtedly hastened his death.

Mr. Gorsline had many friends in Rochester among the machine-tool builders and allied trades, and was actively connected with the Rochester machine industries.

Trade Catalogs

Grover File Handles. The Grover File Co., Nashua, N. H. Booklet. Pp. 8; 6¼ x 3¼ in. This booklet gives a number of illustrations of file handles of various sizes and includes a description and price list of same.

Tilting Reverberatory Melting Furnaces for Non-Ferrous Metals. W. S. Rockwell Co., 50 Church St., New York. Bulletin No. 36. Pp. 8; 8½ x 11 in. Illustrates and describes furnaces ranging from 500 to 2000 lb. in capacity. A table of standard sizes of hand-operated types, and a table of specifications are given.

Bright Annealing Furnaces. W. S. Rockwell Co., 50 Church St., New York. Bulletin No. 37. Pp. 4; 8½ x 11 in. This bulletin illustrates the type of furnace used for annealing copper wire and similar products without oxidation. It contains a number of halftone illustrations showing the various uses of these furnaces.

Vul-Cot Fiber. American Vulcanized Fibre Co., Equitable Bldg., Wilmington, Del. Catalog. Pp. 16; 6 x 9 in. A number of illustrations of the manufacture of Vul-Cot fiber, which is used for machine parts and many articles of commerce, are shown.

Stock List of Cutters. The Cleveland Milling Machine Co., Cleveland, Ohio. Booklet. Pp. 48; 3½ x 6 in. Illustrating the plain-milling cutter, side-milling cutter and spiral-shell end mill; angular cutters; spiral-cut, straight-shank and slotting end mills; metal saws, gear cutters, etc. A table shows the kind of steel, diameter, width of face and various other information.

New Publications

The Style Book of the Detroit "News."—Pocket edition; 92 pages. The Evening News Association, Detroit, Mich. Edition limited to 1000 copies.

This book presents its subject in a concise, clear and forceful manner; in fact it has gone its name one better, and is really a guide book. It gives the aim of the *News* in the first chapter, and under various heads, choosing them at random, may be found instructions to reporters and copy readers; on diction and grammar, and a short dissertation on the law of libel. There are also blank pages for notes. The style recommended by the work is about as consistent as it is possible to make any style, considering the number of authorities that the English language is blessed or cursed with, as one likes. If those that aspire to write will "read, mark, learn and inwardly digest" the advice given in this little work they will avoid many of the outlandish expressions so commonly used and that mean nothing. A. L. Weeds is the editor of the book, though he acknowledges the help he has received from various sources in its compilation.

Forthcoming Meetings

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

New England Foundrymen's Association. Regular meeting, second Wednesday of each month. Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Providence Engineering Society. Monthly meeting fourth Wednesday of each month. A. E. Thornley, corresponding secretary, P. O. Box 796, Providence, R. I.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Technical League of America. Regular meeting, second Friday of each month. Oscar S. Teale, secretary, 240 Broadway, New York.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.